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Precursors to a theory of mind in infants with autism.

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PRECURSORS TO A THEORY OF MIND

IN INFANTS WITH AUTISM

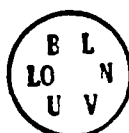
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ABSTRACT

There is a growing body of evidence which suggests that one specific deficit which characterises autism is the lack of a theory of mind. Existing theoretical accounts of the normal development of a theory of mind, and its impairment in autism, provide us with at least four candidate precursors of a theory of mind: affective responsiveness, pretend play, joint attention, and imitation. The present research tested for the presence of these candidate precursor abilities in infants with autism, as well as mental-age and language-age matched infants, and a group of normally-developing children. The subjects with autism were prospectively identified and constitute the youngest sample of children with autism ever studied. Experimental measures of empathy, attachment behaviours, pretend and functional play, joint attention behaviours and imitation were taken. Autism-specific impairments were found on measures of empathy, pretend play and joint attention. No autism-specific differences were found for imitation or attachment. The results therefore provide some support for theories which propose empathic responsiveness, pretend play and joint attention as precursors to the development of a theory of mind, whilst the status of imitation and attachment as precursors is weakened. Importantly, both cognitive and affective measures separated the infants with autism from the controls. In addition to these theoretical considerations, the results are of interest for their potential clinical relevance, most notably in aiding early identification and diagnosis of autism.

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CHAPTER ONE:
AUTISM AND PRECURSORS TO A THEORY OF MIND

1.1 AUTISM

1.1.1 Diagnosis

Autism is a pervasive developmental disorder whose symptomatology is well documented. When first described by Leo Kanner (1943), two types of psychological dysfunction were said to underlie characteristic autistic behaviour: "autistic aloneness" and "an obsessive insistence on sameness". Kanner presented a remarkable series of case studies of 11 children whom he had seen in the John Hopkins Clinic at Baltimore Hospital. He described their "profound lack of contact with other people", and reported that the children appeared aloof and indifferent to other people, especially other children. Their parents described them as "self-sufficient", "acting as if people weren't there" and "happiest when alone". The children were also resistant to changes in their daily routine, and engaged in repetitive non-constructive activities. Whilst some aspects of the descriptions provided by Kanner (1943), and those of Asperger (1944) (who independently described a similar condition, and which he named "autistic psychopathy") have been modified and challenged over the intervening 50 years, the central importance of disturbed social relationships in characterising autism as a pervasive developmental disorder has remained (Baron-Cohen, 1988; Rutter, 1978a,b; 1983).

More recent behavioural descriptions of autism categorize the essential diagnostic criteria under three headings (DSM-III-R/APA, 1987; ICD-10/WHO, 1992; Rutter, 1978a,b):

- * qualitative impairments in reciprocal social interaction
- * qualitative impairments in verbal and non-verbal communication, and in imaginative activity
- * a markedly restricted repertoire of activities and interests.

Typical features of the impairment in reciprocal social interaction shown by children with autism include a marked lack of awareness of the existence of feelings of others; absent or abnormal seeking of comfort at times of distress; absent or impaired imitation; absent or abnormal social play; and an impairment in the ability to make peer friendships.

The impairments in verbal and non-verbal communication characteristic of autism include the lack of developmentally-appropriate modes of communication, such as communicative babbling, gesture, mime, or spoken language; absent or abnormal nonverbal communication, such as use of gaze, facial expression, body posture, or gestures to initiate or modulate social interaction; abnormalities in the form or content of speech, including stereotyped and repetitive use of speech; impairments in the ability to initiate or sustain a conversation with others, despite adequate speech; and abnormalities in the production of speech, including volume, pitch, stress, rate, rhythm and intonation.

The restricted repertoire of activities and interests which characterize autism include stereotyped body movements; persistent preoccupation with parts of objects or attachment to unusual objects; a marked distress over changes made in trivial aspects of environment; an insistence on following routines in precise detail; an absence of developmentally appropriate imaginative activity, such as playacting of adult roles or fantasy characters, or interest in stories; and stereotyped and restricted patterns of interest.

Other prominent features of autism include an impairment of imaginative activity and the presence of excessive repetitive activity (Bartak, Rutter and Cox, 1975; Kanner, 1943; Rutter and Lockyer, 1967; Rutter, 1983; Wing and Gould, 1978); a deficit in pragmatic aspects of language (Baron-Cohen, 1988; Eales, 1993; Frith, 1989a; Tager-Flusberg, 1989, 1993); the absence of symbolic play (Baron-Cohen 1987; Jarrold, Boucher and Smith, 1993; Ungerer and Sigman, 1981) and the presence of ritualistic behaviour (Rutter, 1985).

According to recent diagnostic criteria, evidence of the disorder should be apparent in the first 36 months of life (ICD-10/WHO, 1992; Rutter, 1978a,b; Short and Schopler, 1988). There have been contradictory findings about the significance for prognosis of early identification of autism. Short and Schopler (1988) found that early onset (before 24 months) was related to severity, both as measured by IQ and severity ratings on the Childhood Autism Rating Scale (Schopler, Reichler and Renner, 1986). In contrast, Rogers and DiLalla (1990) found that earlier onset of symptoms was not indicative of a greater severity of autistic symptoms or retardation. The research

reported in this thesis concerns the identification of early indicators of autism in infancy, and the issue of early diagnosis will be discussed in more detail below.

1.1.2 Social development and autism

Social impairment is considered by many as the "primary" symptom in autism (Baron-Cohen, 1988; Kanner, 1943; Rutter, 1983, Volkmar and Klin, 1993). One reason for this is that many children with a primary receptive or expressive language disorder do not necessarily develop a social impairment, suggesting that the social impairment seen in autism is unlikely to be secondary to their language deficits (Bartak et al., 1975). Furthermore, follow-up studies of autistic individuals show that, regardless of progress made in speech and intellectual development, the social impairment is lifelong (Kanner, Rodriguez and Astenden, 1972; Paul, 1987a; Rutter, Mawhood and Howlin, 1992).

The range of autistic social behaviour has been subdivided according to the type of impairment shown in their social contact; namely aloof, passive or active but odd (Wing and Gould, 1979). The "aloof" child with autism is withdrawn and unresponsive to social overtures or speech, makes little use of eye contact, or even avoids gaze, refuses to be cuddled and does not seek comfort when distressed. The "passive" child with autism is indifferent to social responses but accepting of social contact, and complies with instructions. Wing and Gould (1979) considered passive children with autism to be the most distressed by changes in routine. In contrast, the "active but odd" child with autism does initiate social contact, but makes unwanted and

inappropriate responses, and indiscriminately approaches both strange and familiar adults. Whilst Wing and Gould's phenomenological subclassification has yet to be related to clear differences in aetiology and treatment, the subclassifications are useful in plotting the changing nature of the social impairments in autism over development. Wing and Gould (1979) found that the aloof set of characteristics were more common in young childhood, and there was a tendency for autistic children to become either passive or active but odd in later childhood.

1.1.3 Language and autism

Deviant language has been recognised as one of the core features of autism since Kanner's (1943) original description. However, contrary to the initial idea that language may indeed be the primary deficit in autism (Rutter, Bartak and Newman, 1971), it is now generally thought that language disorder is either secondary to the fundamental social impairment (Bartak et al., 1975), or is an independent impairment in its own right. Paul (1987b), in a detailed review of the language impairments of autistic individuals, argued that although some studies have provided contradictory evidence, abnormal features of speech in syntactic structures and grammatical morphology appear to be related to developmental level, and are not specific to autism. Other features do appear to be specific (at least in degree) to autism: echolalia (Schuler and Prizant, 1985), poor use of deictic terms (Bartak and Rutter, 1974), repetitive and stereotyped use of speech (Rutter and Schopler, 1987), narrative construction (Loveland and Tunali, 1993), intonation (especially monotony) (Fay and Schuler, 1980) and stress patterns (Baltaxe, 1984). From the results of a longitudinal

study comparing verbal language acquisition in young normal, Down's syndrome and autistic children, Tager-Flusberg (1981, 1989, 1993) concluded that phonological, syntactic and semantic development in autistic children follows the same course as in normal children (but sometimes at a slower rate), while pragmatic functioning alone appears deviant.

1.1.4 Intelligence and autism

Autism has a strong association with learning difficulties and with organic brain dysfunction. Although autism can occur at any point in the IQ continuum (De Myer, 1976) over three-quarters of autistic children have IQs in the learning difficulties range (Gillberg, 1990; Rutter, 1979). One idiosyncratic feature of the disorder is the relatively high proportion of "idiot savants" who are autistic (Frith, 1989b; O'Connor and Hermelin, 1988). Idiot savants are rare individuals with mental handicap who show outstanding ability in one domain, far in excess of their general intellectual abilities. The most well-known examples are individuals with highly developed drawing skill (Selfe, 1977, 1983; Wiltshire, 1987, 1989), musical skill, rote memory, and calendar calculation (Howe, 1989). There is some theoretical speculation, but little empirical work to date, as to why autism should be over represented amongst the population of savants. One suggestion is that a combination of obsessive interests and an absence of social interests combine to allow time for such singleminded pursuits (Howe, 1989). A second, related suggestion is that these islets of ability may be an indication of the abnormalities in the way children with autism process information (Frith, 1989b). Children with these extraordinary abilities are rare, even amongst the

autistic population. However, Kanner (1943) described "islets of abilities", particularly rote memory and constructional or spatial skills, as a feature of autism, and in many case histories some mention is made of a significant or exceptional ability.

1.1.5 Prevalence

The U. K. prevalence of children showing classic autism (Rutter and Schopler, 1987) is around 4-5 per 10,000 children (Lotter, 1966; Wing and Gould, 1979). However, the prevalence for all children with an autistic-like social impairment in Wing and Gould's study (1979) - those who displayed the characteristic triad of social impairments in verbal and non-verbal communication, and in imaginative activities - is 15-20 per 10,000 (Wing and Gould, 1979). The prevalence of autism is four times higher in boys than in girls (Rutter, 1985; Wing, 1981). More recent epidemiological surveys, employing DSM-III-R diagnostic criteria, have shown higher prevalence figures of around 10 per 10,000 children (Bryson, Clark and Smith, 1988; Cialdella and Mamelie, 1989; Gillberg, Steffenburg and Schaumann, 1990; Tanoue, Oda, Asano and Kawashima, 1988).

Gillberg (1990) suggests three explanations for the discrepancy between the new and older findings: First, that there is an increase in the number of severely retarded children who now receive an additional diagnosis of autism (Steffenburg and Gillberg, 1990). Secondly, there is an unexplained increase in the number of children with immigrant parents who become autistic (Gillberg, Steffenburg and Jakobsson, 1987). Thirdly, a gradually more inclusive conception of autism, as described above, has been

used.

1.1.6 Biology and autism

That there is a link with organic brain function is no longer in doubt (Gillberg, 1990; Golden, 1987), but no specific neurological or neurochemical abnormality has been consistently detected. There is evidence of a hereditary genetic influence from twin and familial studies (Folstein and Rutter, 1977; Steffenburg et al., 1989), although the nature of the genetic deficit is still poorly understood (Bolton and Rutter, 1990). In addition, the discrepant prevalence rates for males and females suggests a sex-linked genetic pattern. Autism is also associated with organic conditions such as epilepsy (Coleman and Gillberg, 1987), Fragile-X Syndrome (Wahlstrom, Gillberg, Gustavson and Holmgren, 1986; Watson et al., 1984), congenital rubella (Chess, Fernandez and Korn, 1978) and tuberous sclerosis (Hunt and Dennis, 1987). Autism also co-occurs with non-genetic biological factors such as perinatal insult (Golden, 1987). Autism may be a syndrome of multiple neurological insults (Andersson, Bohman and Campbell, 1990), although autism with and without demonstrable neurological problems may not differ from the point of view of behaviour (Gillberg, 1990).

1.1.7 Asperger's syndrome and the autistic continuum

Not long after Kanner's (1943) original paper was published, Hans Asperger (1944) independently described the phenomenon of "autistic psychopathy". Asperger's syndrome, as this disorder has come to be known, shares many core features with

Kanner's autism. However, partly because Asperger's paper was written in German, and was not available until recently in English translation (Frith, 1991), it was mistakenly believed that Asperger described a different type of child. In fact, Asperger's definition of autism was wider than that employed by Kanner, principally because Asperger described children who showed severe organic impairments, as well as those more able children whose general intellectual abilities were in the normal range. Today the diagnosis of Asperger's syndrome tends to be reserved for the rare, intelligent and highly verbal autistic person. There is now broad agreement that Asperger's syndrome has many similarities with autism, particularly in the nature of the social impairment which is central to both disorders (Tantam, 1988).

Although precise diagnostic criteria for Asperger's syndrome have yet to gain wide acceptance, there is some agreement that a typical child with Asperger's syndrome is intelligent, verbally fluent, clumsy, and pursues idiosyncratic interests (Tantam, 1988; Gillberg and Gillberg, 1989). Initial studies have shown the prevalence of Asperger's syndrome to be higher than Kanner-type autism, between 10-16 per 10,000 (Ehlers and Gillberg, 1993; Gillberg and Gillberg, 1989). To date there has been comparatively little research on the disorder. Experimental investigation of the underlying deficit in Asperger's syndrome, and the question of whether this is common to both Asperger's syndrome and autism, is still in its infancy (Frith, 1991; Tantam, 1988).

Partly as a consequence of this recognition that Kanner's autism and Asperger's syndrome describe children with similar core social-communication deficits, there has been growing acceptance that there are many individuals who are severely impaired

in social interaction, and who share other features with Kanner's autism, but in whom the manifestation is not as precise as that described by Kanner (1943). Wing (1988) and Bishop (1989) argue that instead of thinking in terms of a discrete syndrome of autism, we should conceptualise autism as a continuum of such disorders. The debate about whether the umbrella label "autism" may contain several separable disorders - separable in terms of aetiology, symptomatology or prognosis - or only one disorder with several different manifestations, has not yet run its course. Whilst the main concern of the present research is children who meet the established diagnostic criteria for autism, some consideration will be given to children who show significant autistic features but who do not fit the classic description of "Kanner autism". In sum, I shall not exclude from consideration children who have Asperger's syndrome or who could be considered to be on the autistic continuum.

1.2 PSYCHOLOGICAL THEORIES OF AUTISM

Theories of autism are proposed at two levels. First, at the underlying level of biology (reviewed above), and secondly, at the psychological level. A general review of the competing psychological theories will be given in this chapter. More detailed accounts of the specific theories which relate to the research of this thesis will be given in subsequent chapters.

1.2.1 Psychogenic theories of autism

Kanner came to two seemingly contradictory conclusions in his landmark paper

(1943). In a psychogenic vein, he noted that there was a great deal of obsessiveness and preoccupation with abstractions in the family background of the 11 children he described, and added that there were "very few really warm-hearted fathers and mothers" in the group. In contrast, he also emphasised that the "autistic aloneness" he described was present from the beginning of life, suggesting a nativist account. Although Kanner initially came down on the organic side, and concluded that the children had been born with an "innate inability to form the usual, biologically-provided affective contact with people", other clinicians (principally within the psychoanalytic community) have developed various theories linking some kind of emotional deprivation to autistic behaviour (Alvarez, 1992; Tustin, 1991, 1994).

Bettleheim (1967) argued that autism resulted from the child perceiving the social environment as traumatic and uncontrollable - due to some subtle form of parental rejection. Tinbergen and Tinbergen (1983), on the basis of ethological observations, concluded that autism arises from a basic fear of social contact, and characterised autism as an active withdrawal from affective contact. Tustin (1991, 1994) has developed a Kleinian-influenced theory. She characterises autistic withdrawal as a response to the traumatic stress of bodily separation from the mother, chronically affecting the development of object relations. More recently, possibly in response to the growing biological evidence, psychoanalytic practitioners have emphasized that autism may have multiple causes (Alvarez, 1992), and that a psychogenic aetiology may apply to only a subset of the total autistic population (Tustin, 1991, 1994). Psychogenic explanations for autism have not gained much ground within the scientific mainstream, for two principal reasons. First, there is considerable evidence

that autism is associated with organic brain dysfunction (reviewed above). Secondly, the nature of the social abnormalities which have been shown to arise from early emotional deprivation differ markedly from those found in autism. For example, institution-reared children tend to be clinging and excessively friendly (Rutter, 1981), and abused children show marked insecurities in their personal attachments (Mrazek and Mrazek, 1985). Neither feature is characteristic of autism.

1.2.2 Affective theories of autism

Amongst those who accept an organic aetiology for autism, there is disagreement about whether cognitive or affective impairments are primary. Leslie and Frith (1990) detail three of the possible relationships between the contributions of affective and cognitive impairments in the pathogenesis of autism. First, there may be a basic affective disorder which somehow produces other cognitive impairments. Secondly, there may be a basic affective disorder independent of, and in addition to, a basic cognitive deficit. Thirdly, there may be a basic cognitive deficit which produces the social-communicative impairments observed, including abnormalities of affect. The contrasting views will be reviewed briefly here as an introduction to the debate, and at more length, where relevant, in subsequent chapters.

Hobson's (1993a,b, 1990b,c) theory of autism characterizes the primary deficit as affective in nature. This therefore corresponds to the first option above. Hobson argues that an innate inability to relate and respond emotionally to others causes the observed social impairment in autism. His account is not without problems, however, as

emotion-recognition deficits, cited by Hobson as evidence for his theory (Hobson, 1986a,b), have not been found in later studies when groups were matched on verbal mental age (Hobson, Ousten and Lee, 1988a,b, 1989; Ozonoff, Pennington and Rogers, 1990; Prior Dahlstrom and Squires, 1990; Tantam, Monaghan, Nicholson and Stirling, 1989). Furthermore, emotion-recognition deficits are also found in a range of other disorders, such as schizophrenia (Cutting, 1981), abused children (Camras, Grow and Robordy, 1983) and general mental handicap (Gray, Fraser and Leudar, 1983). Finally, some interpersonal emotional responsivity is frequently present in autism (Shapiro, Sherman, Calamari and Koch, 1987; Sigman and Ungerer, 1984a). In favour of his thesis, though, are experiments showing deficits in empathy in autism (Sigman, Kasari, Kwon and Yirmiya, 1992; Yirmiya, Sigman, Kasari and Mundy, 1992). Hobson's theory is one of those tested by the research reported in this thesis and will be described in more detail below (Chapter 3).

1.2.3 Cognitive theories of autism

Several cognitive theories of autism have been proposed. Rutter (Rutter et al., 1971) initially characterised autism as primarily a language disorder, with the social and affective impairments being due to delayed and disordered language development. Following a comparison of children with autism and children with specific language disorders, Rutter and his co-workers changed their original understanding and accepted the primacy of the cognitive deficit above that of language (Bartak et al., 1975). Hermelin and O'Connor (1970) found people with autism to be specifically impaired (relative to a control group of people with mental handicap) in tasks which require

comprehension of meaning, and to process information in a qualitatively different way. For example, children with autism were found to store visual information using a visual code, whereas normal children tend to recode such information into a verbal/auditory code (Hermelin, 1978)). Shah and Frith (1983, 1993) found that autistic children were more accurate than control groups of children with a similar mental age in their ability to perceive "embedded figures" - an ability which involves analyzing complex visual patterns in order to identify smaller patterns embedded within them. On the basis of evidence from such cognitive experimental tasks, Frith (1989b) proposed that cognition in autism is characterised by a lack of high-level "central cohesive forces" which affects all areas of cognitive processing. She suggests that it is this cognitive deficit which underlies the characteristic social impairments and repetitive behaviour.

Cognitive theories of autism have to account for the fact that autistic children's social development is not impaired in a blanket fashion. Certain aspects of their social development have been shown to be relatively intact in groups of autistic children: attachment behaviours i.e. proximity-seeking (Sigman and Ungerer, 1984a); simple levels of social interaction i.e. amount (but not style) of eye contact and reaching (Mundy, Sigman and Kasari, 1993; Mundy, Sigman, Ungerer and Sherman, 1986); gestural requests in social routines (Wetherby and Prutting, 1984); the use of protoimperatives i.e. requesting toys using gestures (Attwood, Frith and Hermelin, 1988); preference for a real over a photographed face (O'Connor and Hermelin, 1967). However, there exists a large literature documenting specific deficits in the social development of autistic individuals. In infancy, at least from retrospective accounts,

autistic children show less smiling and crying (Volkmar, 1987), inappropriate use of eye contact (Mirenda, Donnellan and Yoder, 1983), and a poor quality of attachment relationships. They are commonly described as "aloof" and "distant". Autistic children also show deficits in turn-taking in dialogue and play (Fay and Schuler, 1980), qualitatively different strategies in face-recognition (Goode, 1985; Langdell, 1978), poor intermodal matching of different emotional indices (Hobson, 1986a,b), a preference to match photographs according to nonaffective stimuli (e.g. hats) rather than expressions (Jennings, 1973; Weeks and Hobson, 1987), and a striking lack of shyness or embarrassment in front of a mirror (Baron-Cohen, 1985; Spiker and Ricks, 1984). They also lack empathy (Sigman et al., 1992) and, as previously mentioned, are impaired in the pragmatics of language (Tager-Flusberg, 1993).

In sum, some aspects of social cognition have been shown to be impaired in autism and others have not. In order to explain this uneven pattern, some researchers have proposed that the specific cognitive deficit which characterises autism is the lack of a "theory of mind" (Baron-Cohen, Leslie and Frith, 1985; see Baron-Cohen, 1993 for a review). In what has become a landmark experiment, Baron-Cohen et al. (1985) brought together ideas from empirical and theoretical work on social cognition in young normal children and research in the field of autism. Over the past decade a considerable body of empirical work has furthered our knowledge of this deficit. The evidence for the nature and role of the theory of mind deficit in autism will be considered in some detail as it is central to the experiments which form the core of the present research.

1.2.4 Theory of mind

The phrase "theory of mind" was originally used by the primatologists Premack and Woodruff (1978), who defined it as follows:

"In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and others...A system of inferences of this kind is properly viewed as a theory, first because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms." (p.515)

The term theory of mind has also been used more recently by developmental psychologists (eg: Astington, Harris, and Olson, 1988; Bretherton, McNew, and Beeghly-Smith, 1981; Frye and Moore, 1991), to refer to the everyday ability to think about one's own and other people's mental states, and to explain and predict behaviour in terms of mental states.

Two commentaries on Premack and Woodruff's paper explored further the cognitive processes that are necessary for the existence of a theory of mind. Dennett (1978a) suggested that the ability to impute mental states to oneself and others necessarily involves beliefs, knowledge, desires etc. about the beliefs, desires etc. of others. For example, Sarah *knows* that John *wants* some chocolate. Dennett called beliefs about beliefs, beliefs about desires etc. "second order" beliefs/desires etc., and suggested that they are dependent on "second-order representations". Pylyshyn (1978) emphasized the

relevant cognitive processes. He argued that in order to have a theory of mind it is necessary to have a "meta-representational ability". In order to be able to attribute mental states to others an individual must not only have some kind of internal representation of things in the external world; the individual must also be able to represent the relationships in which people stand to things in the external world, such as the relationships of *wanting* (some chocolate), *believing* (that snow is black), *pretending* (a banana is a telephone). Finally, the individual must be able to reflect on these relationships. It is this reflective capacity which Pylyshyn called metarepresentational ability. Both Leslie's (1987) and Perner's (1991) use of the term metarepresentation and its relevance to autism are discussed in detail later (Chapter 4).

A theory of mind is also sometimes referred to as "folk psychology" (eg: Dennett, 1978b) or knowledge (rather than theory) of mind (eg: Hobson, 1991a). Whatever one chooses to call it (and the term "theory of mind" is used simply because it has now acquired widespread value as psychological shorthand) it appears that most children with autism are severely delayed in developing this ability, if indeed they ever develop it at all (Holroyd and Baron-Cohen, 1993). Much of the clearest evidence of this deficit derives from studies using the so-called False Belief test, in which the subject has to identify either their own or someone else's false (and therefore different) belief.

Dennett (1978a) argued that false belief might constitute a 'litmus test' of a theory of mind, in that in such cases it becomes possible to distinguish unambiguously between the child's (true) belief and the child's awareness of someone else's different (false)

belief. An experimental test of normal children's understanding of the mental state "belief" was developed by Wimmer and Perner (1983). They selected belief as the mental state to test because this is arguably the clearest case of a mental state that is *about* something in the world (Dennett, 1978b) i.e. it is a mental state that possesses intentionality (Searle, 1965). Their test is based on a puppet story in which a character holds a false, and therefore different, belief to that held by the child. Children are scored as passing this test if they can demonstrate that they can take account the story character's different belief, and that they can predict the character's action, given her false belief. Wimmer and Perner (1983) demonstrated that around 3 to 4 years of age children can pass such a test, a result that has been much replicated in the intervening years (see Astington and Gopnik, 1991; for a review). Baron-Cohen et al. (1985) adapted the test for use with children with autism, and comparison groups of children with Down's syndrome and normally-developing children. 80% of the autistic children failed to impute beliefs to others on a False Belief task, instead giving a realist answer, while over 85% subjects from both comparison groups passed on both trials. Given that the children with autism had a higher chronological age (CA) and mental age (MA) than either of the two groups, and answered control questions perfectly, this initial study gave strong support to the notion that children with autism have a weak understanding of belief.

In a series of experiments, autistic children have been shown to be impaired relative to non-autistic controls (both normal and learning disabled) in their performance on False Belief tasks that, according to Wimmer and Perner (1983) and Dennett (1978a), involve the use of a theory of mind. Baron-Cohen et al.'s (1985)'s result has been

replicated in subsequent studies, using a number of different False Belief paradigms. Some have used real people (Leslie and Frith, 1988; Perner, Frith, Leslie and Leekam, 1989; Russell, Mauthner, Sharpe and Tidswell, 1991; Shaw, 1989; Sodian and Frith, 1990), whilst others have used picture stories (Baron-Cohen, Leslie, and Frith, 1986) or dolls (Baron-Cohen, 1989a,b; Harris and Muncer, 1989; Leekam and Perner, 1991; Leslie and Thaiss, 1992), or direct questioning (Dawson and Fernald, 1987), and even computer-generated images (Swettenham, 1992). In addition, Perner et al. (1989) and Charman and Baron-Cohen (1992) have replicated the result using a test which makes fewer informational demands but which tests understanding of false belief (the "smarties" task). To date, only three published studies have obtained mixed results (Oswald and Ollendick, 1989; Prior, Dahlstrom and Squires, 1990; Tager-Flusberg and Sullivan, 1994), the reasons for which remain to be explored. However, the number of successful replications suggests that the effect is fairly robust.

Baron-Cohen (1989a) and Ozonoff, Pennington and Rogers (1991a) have also demonstrated that even the 20% of autistic subjects who possess a theory of mind at the lowest level (demonstrated by passing the False Belief paradigm) fail at the level of imputing second-order beliefs to others (e.g. Mary *thinks* John *thinks* the ice-cream van is in the park). The subjects with autism had a mean verbal MA (VMA) of over seven years, the age by which the task is passed by normally-developing children (Perner and Wimmer, 1985). Ozonoff, Rogers and Pennington (1991b), however, found that some adults with Asperger's syndrome do reach this level. The fact that some older and more able subjects with autism, in particular "high functioning" children with autism and children with Asperger's syndrome, are able to pass both

first- and second-order theory of mind tests fits with a development delay hypothesis of autism (Baron-Cohen, 1991a). However, even these rare more able with children continue to show impairments on more naturalistic story tasks which involve second-order mentalizing ability (Happe, 1994b), as well as in everyday social situations (Bowler, 1992; Happe, 1994b).

Following on from these investigations testing if children with autism understand belief - chosen as the clearest mental state exemplar - other studies have looked at their understanding of other mental states, such as desire, knowledge, pretence, perception and emotion. Children with autism have been shown to be impaired in their understanding of knowledge compared to mental handicap controls (Baron-Cohen and Goodhart, 1994; Leslie and Frith, 1988; Perner et al., 1989; Reed and Peterson, 1990), though these findings suggest that understanding of knowledge is slightly easier than understanding belief. Whilst understanding of pretence has not been widely studied (Jarrold, Smith, Boucher and Harris, 1994), several experiments have assessed the production of pretend play by children with autism. There have been some contradictory results (Jarrold et al., 1993; Lewis and Boucher, 1988), and discussion about what the findings mean is continuing (Harris, 1993), but the majority of studies demonstrate specific deficits in the spontaneous production of pretence (Baron-Cohen, 1987; Charman and Baron-Cohen, 1994b; Ungerer and Sigman, 1981; Wing and Gould, 1979). The production of pretence is considered in more detail in Chapter 4. Whilst understanding and recognition of simple emotions (caused by situations and desires) has been shown to be intact in children with autism, comprehension of complex emotions (caused by beliefs) is impaired (Baron-Cohen, 1991b; Baron-Cohen,

Spitz and Cross, 1993). However, understanding of simple desires (Baron-Cohen, 1991b; Tan and Harris, 1991) and Level-1 and Level-2 perceptual role-taking (Flavell, Everett, Croft and Flavell, 1981) have been shown to be intact (Baron-Cohen, 1989c, 1991c; Hobson, 1984; Lelsie and Frith, 1988, Reed and Peterson, 1990; Tan and Harris, 1991).

Other aspects of social cognition which do not rely on an understanding of one's own or another's mental states have been shown to be intact and mental-age appropriate in autism: person permanence (Sigman and Mundy, 1989); self-recognition (Dawson and McKissick, 1984; Spiker and Ricks, 1984); age-recognition (Baron-Cohen, 1991b); gender-recognition (Weeks and Hobson, 1987); identity-recognition (Langdell, 1978; Goode, 1985; Hobson et al., 1988a,b), relationship-recognition (Baron-Cohen 1991b), and making the animate-inanimate distinction (Baron-Cohen, 1991b). In addition, a series of studies has shown that whilst children with autism are impaired in their understanding of epistemic states, such as knowing and believing, they are unimpaired in their understanding of non-mental representations, such as photographs, drawings, maps and models (Charman and Baron-Cohen, 1992, 1993, 1994c, Leekam and Perner, 1991; Leslie and Thaiss, 1992). Whilst this has been interpreted by some commentators as evidence for the specificity of the modular deficit in autism, which is restricted to understanding mental states (Baron-Cohen, 1994; Leslie and Thaiss, 1992), there is disagreement over whether these tasks make equivalent demands to the false beliefs tasks (Hughes, Russell and Robbins, 1994).

Gopnik and Slaughter (1991) mapped the acquisition of an understanding of different

mental states in normally-developing children between 3 and 4 years of age. Perception, imagination and pretence emerge first, with desire more difficult and belief the hardest mental state of all to comprehend. Baron-Cohen (1991a) also replicated this developmental sequence for children with a mental handicap. However, amongst children with autism the pattern was different. They too found perception the easiest, and belief the most difficult mental state. Unlike the normal and mental handicap control groups, the children with autism found imagination and pretence more difficult than desire (Baron-Cohen, 1991a). These results suggest that the acquisition of a theory of mind in autism may be both delayed and deviant (Baron-Cohen, 1991a, 1992, 1993). The recognition that children with autism have a deviant, as well as a delayed, development of a theory of mind is important, since it implies that a child with autism is not simply the same as a younger normal child.

A delayed, absent or deviant development of a theory of mind will have specific and general consequences for other aspects of a child's social and cognitive development. Specifically, children with autism have been shown to be impaired in establishing a conceptual distinction between mental and physical entities and distinguishing appearance from reality (Baron-Cohen, 1989b; Ozonoff et al., 1991a). Similarly, a lack of a theory of mind has serious consequences for language and communicative development. Tager-Flusberg (1993) argues that language is inextricably tied to our understanding of minds, and that specific forms and functions of language appear to have been designed for communicating with other people about mental states. Tager-Flusberg (1992) demonstrated that children with autism produce fewer calls for joint attention or references to cognitive mental states, than children without autism

matched on mean-length-of-utterance (MLU).

Similarly, the characteristic language abnormalities in prosodic features shown by children with autism - atypical patterns of rhythm, stress - (Baltaxe and Simmons, 1985; Van Lancker, Cornelius and Kreiman, 1989), and impairments in pragmatics (Paul, 1987b; Tager-Flusberg, 1981, 1989) and narrative (Loveland and Tunali, 1993), are explicable in terms of their lack of a theory of mind (Baron-Cohen, 1988; Tager-Flusberg, 1993). Further, lacking a theory of mind would make the social world and other people's behaviour confusing, and lead to the disordered social interactions characteristic of autism, as set out in the introductory section above. Rutter and Bailey (1993), in their review of the explanatory power of the theory of mind deficit hypothesis of autism, acknowledged that it is in explaining the third cardinal feature of autism - stereotyped and repetitive patterns of behaviour - that the theory meets most problems. Baron-Cohen's (1989b) suggestion that stereotypies may in part serve to reduce the anxiety generated by a failure to understand social situations has yet to be tested empirically. Competing theories, such as Frith's (1989b) central cohesion theory and a third alternative, the "executive dysfunction theory" (Bishop, 1993; Harris, 1993; Hughes and Russell, 1993; Hughes et al., 1994; Ozonoff et al., 1991a,b; Prior and Hoffman, 1990) may be better able to explain repetitive and stereotypic behaviour. The strong version of both theories subsume theory of mind deficits to their more fundamental deficit. It is clearly not the case that an executive dysfunction necessarily causes a theory of mind impairment, since an executive dysfunction is found in a range of clinical populations without any obvious deficit in theory of mind (e.g. obsessive, compulsive disorder, schizophrenia, attention deficit hyperactivity disorder,

phenylketonuria) (Baron-Cohen and Ring, 1994). Experimental work to separate out the effects of central cohesion and executive function from understanding mental states has yet to be conducted. The present research does not address this issue, but instead explores some possible origins of the delayed and deviant development of a theory of mind in very young children with autism.

1.3 PRECURSORS OF A THEORY OF MIND

1.3.1 Adopting a developmental perspective

Developmental accomplishments rarely emerge suddenly, fully-formed. Rather, development may precede via a sequence of stages or phases, each of which may represent an increasingly mature ability in the social skill or cognitive process of concern. This seems likely to be true of theory of mind. Gopnik and Slaughter (1991) and Baron-Cohen (1991a) have demonstrated that normal children between 3 and 4 years of age find perception, imagination and pretence the most easy mental states to understand, desire slightly more difficult, and belief the most difficult mental state to understand. Similarly, Wellman (Wellman, 1993; Wellman and Wooley, 1990) has demonstrated that 2-year-olds understand quite well that people have desires for things, and that because of their desires they act to try and get those things. Wellman has (1990, 1993) characterised 2-year-olds as "desire psychologists" who understand desires but not beliefs, before they go on to be full-fledged "belief-desire psychologists" at the age of 3 or 4. Baron-Cohen (1993) elaborates this to suggest toddlers have an "attention-goal psychology". Gopnik and Slaughter (1991) suggest

a three-stage model of the development of children's comprehension of mental states:

- * Stage 1: pretence, perception, and imagination
- * Stage 2: desire and intention
- * Stage 3: knowledge and belief.

Gopnik and Slaughter argue that Stage 1 mental states are easiest because they are nonrepresentational. Stage 3 states are thought to be the most difficult because they are representational states with truth conditions i.e. they are logically "opaque" (Searle, 1965). Stage 2 are of intermediate difficulty because they are representational states with conditions of satisfaction rather than truth conditions. They summarise the distinction between Stage 2 and Stage 3 thus:

"In spite of the similarities between beliefs and desires there are also important differences between the two states. Searle has described these differences by saying that desires and intentions have a "world to mind" direction of fit while beliefs have a "mind to world" direction of fit. That is, in the case of beliefs we alter our minds to fit the way the world is, while in the case of desire and intention we alter the world to fit the way our mind is." (p. 100)

1.3.2 What is a precursor?

According to this developmental perspective early understanding of pretence and shared perception may underlie, or precede, an understanding of desire and belief.

That is, they may be "precursors" of the development of a mature theory of mind. But what does the term precursor mean when it is employed in developmental psychology?

Hay and Angold (1993) emphasise two aspects of a precursor. First, that early forms of a disease (or developmental outcome) must be meaningfully related to the full blown pathological (or developmental) outcome. Second, that a precursor can function as a "harbinger" - a thing that goes before and indicates the approach of something else. They add that in the sense that precursor is used by developmentalists and pathologists a precursor does not simply predict a later state or behaviour, but rather is structurally, functionally, or mechanistically related to it. Angold and Hay (1993) list four types of evidence that can be used to support the claim that one state is a precursor of another:

- * Resemblance between the two states
- * Stability of individual differences from one state to the next
- * Evidence that emergence of the first state is a prerequisite for the second to occur
- * Experimental disruption or manipulation of the first state has predictable consequences for the second.

However, evidence which meets just one of these criteria is not sufficient - for example, behavioural isomorphism may indicate homotypic continuity, rather than a precursor relationship.

In a similar account, Gomez, Sarria and Tamarit (1993) outline two conceptual meanings of the term precursor. First, a precursor might announce the coming of something else (which Gomez et al. (1993) coin the "John the Baptist" way of being a precursor). The precursor signals or "announces" the advent of more complex capacities (possession of a theory of mind). An alternative meaning of a precursor is when the former precursor "substance" can be transformed into the latter. Gomez et al. (1993) term this the "chemical" way of being a precursor. These different definitions of a precursor remain to be explored empirically in autism.

Sigman and Mundy (1993) compare the possible precursor relationships in the development of children with Down's syndrome and children with autism. They conclude that different variables may be important precursors of development in different populations of children. The example they provide of such a dissociation is that in children with Down's syndrome nonverbal requesting but not joint attention skill is an important correlate of language development, while the converse is true for children with autism (Kasari, Sigman, Mundy and Yirmiya, 1990; Mundy et al., 1993).

What early-developing social-cognitive abilities may be developmental precursors of a theory of mind? The central focus of the present research will be to investigate the presence of four putative precursors of a theory of mind in infants, some of whom have been selected from a larger sample as having likely social-communication problems, including autism. Detailed reviews of the theoretical and empirical evidence for each of these candidate precursors of a theory of mind will be given in subsequent chapters. Only a brief introduction to each of the proposed precursors will be given

here.

1.3.3 Affective responsivity as a possible precursors of a theory of mind

Hobson (1990a,b,c; 1993a,b) has argued that children with autism fail to develop an adequate concept of persons and of the mind because of an impairment in biologically-based capacities for engaging in personal relatedness, especially affective relatedness. Following Stern (1985) and Trevarthen (1979), Hobson argues that it is through "primary intersubjectivity" (also called reciprocal personal relatedness) that the infant differentiates persons from things and embarks on a line of development towards more explicit understandings of the mental life of self and other people. Hobson (1993a,b) goes on to argue that this affective deficit causes the impairments seen in pretence and joint-attention behaviours, as well as face- and emotion-recognition deficits, and, in time, the development of a theory of mind.

In a related theory, Fonagy (1991; Fonagy, Steele, Steele, Moran and Higgitt, 1991b) has predicted that a caregiver's capacity to conceive of and think about relationships in terms of mental processes and functions will determine the infant's security of attachment, which in turn will influence the child's development of a "prereflexive self", and later a "reflexive self" or "internal observer of mental life" - in other words, its theory of mind. Although children with autism do show some attachment behaviours (Rogers, Ozonoff and Maslin-Cole, 1991; Shapiro et al., 1987) - such as directing more behaviour to a parent than to a stranger, and halting crying in experimental strange-situations - children with autism show qualitative differences in

their attachments relationships compared to normally-developing children. They are less likely to show or share an object with a parent (Dawson, Hill, Spencer, Galpert and Watson, 1990), they show less affect to parents (Yirmiya, Kasari, Sigman and Mundy, 1989), and Rogers et al. (1991) found that attachment security was related to other developmental variables in children with autism but not in mental handicap controls.

1.3.4 Pretend play as a possible precursor of a theory of mind

Leslie's (1987) metarepresentation theory places great emphasis on the emergence of pretend play at around 18 months of age. In his view the emergence of pretence is seen not as a development in the understanding of objects and events as such, but rather as the beginning of a capacity to understand cognition itself. It is an early symptom of the human mind's capacity to characterize and manipulate its own attitudes to information i.e. *knowing* that a banana is a banana *and pretending* that the banana is a telephone at the same time - in Leslie's terminology, to metarepresent. There is considerable evidence that children with autism are specifically impaired in some aspects of their production of pretend play (Baron-Cohen, 1987; Sigman and Ungerer, 1984b; Ungerer and Sigman, 1991; see Harris, 1993 and Jarrold et al., 1993; for reviews).

1.3.5 Joint attention as a possible precursor of a theory of mind

Baron-Cohen (1989c, 1991c, 1993, 1994) and Mundy and Sigman (1989; Mundy et

al., 1993) have claimed that understanding the mental state of attention may be a precursor in the early development of a theory of mind. Normal infants from about 9 months of age reveal this understanding of another person's attention during gaze-monitoring (Scaife and Bruner, 1975), and through gestures such as protodeclarative pointing (Bates, Benigni, Bretherton, Camaioni and Volterra, 1979). In gaze-monitoring, children appear to not only check where someone is looking, but also how the person is evaluating what they see (is it interesting? safe? funny? etc.), as is evident in the phenomenon of social referencing. In protodeclarative pointing, children appear to use the pointing gesture not only to direct another person's attention to an object, but also to "comment" on it as a topic of interest, concern, fun etc. Again, there is considerable experimental evidence that children with autism are specifically impaired in producing and following protodeclarative pointing (Baron-Cohen, 1989c, 1991c; Mundy and Sigman, 1989), and in gaze-monitoring (Leekam, Baron-Cohen, Perrett, Milders and Brown, 1993). Recently, Baron-Cohen (1994) has extended and summarized his model, detailing the architecture of the possible role of joint attention as a developmental precursor to a theory of mind. He focuses on joint attention, in the form of the Shared Attention Mechanism (SAM), as the fulcrum. Whilst, joint attention ability develops via inputs from a range of more primitive perceptual mechanisms (the Intentionality Detector (ID) and the Eye Direction Detector (EDD)), it is the *triadic representations* that SAM processes which directly facilitate the development of Leslie's Theory of Mind Mechanism (ToMM) (Leslie and Thaiss, 1992).

1.3.6 Imitation as a possible precursor of a theory of mind

Meltzoff and Gopnik (1993) have recently linked impaired imitation in children with autism to their failure to develop a theory of mind, stating that "it provides the first, primordial instance of infants making a connection between the visible world of others and the infant's own internal states". They suggest that children with autism may fail to develop imitation because of an impairment in their capacity for recognising the cross-modal correspondences between their own movements and the movements of others. Rogers and Pennington (1991) develop a similar hypothesis, emphasizing the important role of imitation in the development of social reciprocity and intersubjectivity, affective sharing, and social learning. One problem is that these skills are not well-defined. In their model, imitation, affective sharing and theory of mind are increasingly more complex expressions of the basic ability to form and coordinate representations of self and other. Recent reviews of imitation in autism (Meltzoff and Gopnik, 1993; Rogers and Pennington, 1991) conclude that most studies find a specific impairment. It should be noted, however, that in comparison to other early-developing abilities, not all imitation skills are grossly delayed (Charman and Baron-Cohen, 1994a).

1.4 THE EARLY DIAGNOSIS OF AUTISM

1.4.1 Age of diagnosis

Autism is a syndrome which is usually considered to have its onset in infancy

(Gillberg et al., 1990). However, there has been some disagreement about the necessary status of early onset for the diagnosis of the disorder. Whilst some diagnostic criteria specify that abnormalities must have been evident in either the first 30 months of life (Rutter, 1978b), or the first 36 months (draft version of ICD-10; WHO, 1992), DSM-III-R (APA, 1987) recently discarded the age of onset criterion in its operational definition of "autistic disorder", requiring only that the age of onset be recorded. Whatever the status of a specific age of onset, detection of autism does not routinely occur until at least the third birthday in most countries, and usually considerably later than this. Baron-Cohen, Allen and Gillberg (1992) attribute this disparity to the following factors:

- * The fact that primary health practitioners are not specifically trained to detect autism early
- * The focus of routine developmental screening is on motor, intellectual and perceptual development - factors which are not specifically impaired in autism
- * The rarity of the disorder
- * The difficulty of assessing subtle abnormalities in social and communicative development in the pre-school period.

Early diagnosis is important for clinical reasons (Baron-Cohen and Howlin, 1993). Early detection of disorders enables practitioners to maximize the information given to parents to help them understand a child's current functioning, possible aetiological factors, and the likely prognosis. This is often especially important in autism, where parents may feel upset not only by their child's handicaps, but also by the isolating

experience of caring for a child with a pervasive communication disorder, who may not seek affection or social contact with their parents. Parents, sometimes unfortunately encouraged by professionals, may tend to blame themselves for their child's lack of engagement and poor social understanding and response (Aarons and Gittens, 1992). One goal of early identification of any disorder should be the channelling of the child and family into the appropriate sources of care and support. Features of autism such as the specific problems in social communication and understanding, and the preference for routines, have implications for the care and education of a child with autism.

1.4.2 Retrospective studies and early diagnosis

Gillberg et al. (1990) report on the diagnosis of a series of children referred to their clinic aged between 8 and 35 months. They list the factors, reported retrospectively by parents to be the first indicators of abnormality, which best discriminated between autism and other developmental disorders. These included joint attention behaviours (empty gaze, not attracting adult's attention to their activities, difficulties getting eye contact, lack of protodeclarative pointing), communication deficits (suspicion of deafness, late speech development, cannot indicate wishes, does not listen when spoken to) and other unusual aspects of behaviour (over-excited when tickled, only plays with hard objects, only interested in certain parts of objects). Similar features have been reported to be early indicators of abnormality in other retrospective studies (Ohta, Nagai, Hara and Sasaki, 1987). More recently, a series of reports have appeared which analyze home videos taken of children who go on to receive a diagnosis of

autism, before such a diagnosis was made (Adrien et al. 1991a,b, 1992; Osterling and Dawson, 1994). The behaviours which were typically observed in children under 2 years of age included (Adrien et al., 1991a):

- * Disorders of social interaction (tendency to isolation, no eye-contact, lack of anticipatory movements, lack of initiative)
- * Emotional disorders (deficit of facial expressions, absence of smiles, anxiety in new situations)
- * Perceptual abnormalities (unusual use of gaze, slow response to speech, hypo- or hyper-responsive to noise)
- * Motor abnormalities (hypotonia, hand flapping)
- * Atypical behaviour (self stimulation, obsessive behaviour, stereotypic behaviour).

In a recent study which examined the health records taken at 6-, 12- and 18-months of age of a group of children who went on to be diagnosed as autistic, impairments and abnormalities in the social domain were not apparent until 18 months (Johnson, Siddons, Frith and Morton, 1992). These reports have contributed to a growing acknowledgement by clinicians and researchers that there are characteristic abnormalities identifiable during the infancy of children with autism.

1.4.3 Prospective early diagnosis

To date, only one prospective diagnostic study has been conducted. Baron-Cohen at

al. (1992) employed a new instrument, the *CHecklist for Autism in Toddlers (CHAT)*. This is shown in Figure 1. The CHAT checks for the presence of two candidate precursor of a theory of mind abilities, pretend play and joint attention behaviours, as well as unrelated developmental accomplishments such as rough and tumble play. The CHAT was administered during the routine 18-month-old developmental check-up by Health Visitors and General Practitioners. Baron-Cohen et al. (1992) found that while some of a group of 50 randomly selected toddlers between 17 and 21 months of age still lacked protodeclarative pointing, and some lacked pretend play, none lacked both. 41 siblings of already diagnosed children with autism were also screened with the CHAT between the ages of 18 and 21 months. For genetic reasons (Bolton et al., 1994; Folstein and Rutter, 1977) 2-3 per cent of these children would be expected to go on to develop autism themselves. As such, this second group constituted a "high risk" group for autism. Four of these children lacked *both* pretend play and joint attention at eighteen months. From both groups *only* these four children went on to receive a diagnosis of autism at the age of thirty months. The CHAT was used in the selection of the sample for experimental study in the present research, and its properties will be considered in more detail later (Chapter 2).

1.5 THE PRESENT RESEARCH

The present research is an experimental investigation testing for the presence of the putative precursor of theory of mind abilities in infants with autism. The performance of infants with autism will be compared with that of infants matched for verbal

THE CHAT

(Medical Research Council Project)

To be used by GP's or Health Visitors during the 18 month developmental check-up.

Child's name:..... Date of birth:..... Age:.....

Child's address:..... Phone Number:.....

SECTION A: ASK PARENT:

- | | | |
|-------------------------------------------------------------------------------------------------------------------------|-----|----|
| 1. Does your child enjoy being swung, bounced on your knee, etc? | YES | NO |
| 2. Does your child take an interest in other children? | YES | NO |
| 3. Does your child like climbing on things, such as up stairs? | YES | NO |
| 4. Does your child enjoy playing peek-a-boo/hide-and-seek? | YES | NO |
| 5. Does your child ever PRETEND, for example, to make a cup of tea using a toy cup and teapot, or pretend other things? | YES | NO |
| 6. Does your child ever use his/her index finger to point, to ASK for something? | YES | NO |
| 7. Does your child ever use his/her index finger to point, to indicate INTEREST in something? | YES | NO |
| 8. Can your child play properly with small toys (eg: cars or bricks) without just mouthing, fiddling, or dropping them? | YES | NO |
| 9. Does your child ever bring objects over to you (parent), to SHOW you something? | YES | NO |

SECTION B: GP or HV OBSERVATION:

- | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| i. During the appointment, has the child made eye contact with you? | YES | NO |
| ii. Get child's attention, then point across the room at an interesting object and say "Oh look! There's a (name a toy)!" Watch child's face.
Does the child look across to see what you are pointing at? | YES | NO ★ |
| iii. Get the child's attention, then give child a miniature toy cup and teapot and say "Can you make a cup of tea?"
Does the child pretend to pour out tea, drink it, etc? | YES | NO ★ |
| iv. Say to the child "Where's the light?", or "Show me the light".
Does the child POINT with his/her index finger at the light? | YES | NO ★ |
| v. Can the child build a tower of bricks? (If so, how many?)
(Number of bricks:.....) | YES | NO |

★ (To record YES on this item, ensure the child has not simply looked at your hand, but has actually looked at the object you are pointing at).

★ ★ (If you can elicit an example of pretending in some other game, score a YES on this item).

★ ★ ★ (Repeat this with "Where's the teddy?" or some other unreachable object, if child does not understand the word "light". To record YES on this item, the child must have looked up at your face around the time of pointing).

(VMA) and non-verbal mental age (NVMA), as well as with a group of normally-developing infants. Experimental measures of affective responsivity, attachment behaviours, pretend and functional play, joint attention behaviours and imitation will be taken, as well as measures of the children's language abilities and non-verbal functioning.

There are three unique features to the research. These are briefly highlighted here and will be discussed in more detail in subsequent chapters. First, the majority of experimental work in the autism field to date has used school-age, adolescent and young adult subjects. This has much to do with the relatively late age of diagnosis and rarity of the disorder which makes prospective identification difficult. The present sample of children were prospectively identified (see Chapter 2), and represent the youngest sample of autistic children studied experimentally to date. Previous descriptions of the social-communication abilities of children with autism during infancy have relied on retrospective accounts (reviewed above, Section 1.4.2), and the opportunity to study children with autism at this young age has been long anticipated.

Secondly, while some previous studies have examined the relationships between *pairs* of precursor abilities in normal and autistic children - Kasari et al. (1990) measured affect and joint attention behaviours, and Mundy et al. (1993) compared functional and symbolic play and joint attention - no study to date has examined the interrelationships between a larger range of early-developing social-communication skills in a sample of children with autism.

Importantly, the use of subjects matched for VMA and NVMA and normally-developing infants, in addition to testing children with autism, enables a test of the status of the proposed precursors of a theory of mind. The following research strategies will be adopted: First, since older children with autism are known to be impaired in their acquisition of a theory of mind (Baron-Cohen, 1993), *intact* development of any of the earlier-developing social-communication behaviours which have been proposed as precursors would weaken their likely status as a developmental precursor of a theory of mind. Secondly, if the children with developmental delay, but without autism, are impaired in any of the precursor abilities, then the precursor may be developmentally related to general developmental delay, rather than autism-specific impairments which later manifest themselves as an impaired or absent theory of mind.

The third issue to highlight about the present research is that experimental investigations with very young children may contribute to new measures with which to diagnose autism. The precursor abilities to be assessed overlap with the early indicators reported retrospectively by parents and those identified on early videotapes (reviewed above). Baron-Cohen and Howlin (1993) suggest that theory of mind tests might provide a possible aid to diagnosis of autism, in that they rely not on clinician's qualitative judgements of abnormality, but on an objective test of a specific cognitive ability. Much more work into the specificity and sensitivity of such tests, and those that test executive functioning (Ozonoff et al. 1991a,b; Prior and Hoffman, 1990), will be necessary before they could be used clinically. Baron-Cohen and Howlin (1993) point out that since theory of mind tests can only meaningfully be used with children whose mental age is above 4 years of age, their role would be confined to that of

relatively late confirmatory diagnosis. However, tests of precursors of a theory of mind, which develop in the first two years of life, offer the prospect of aiding the *early* detection and diagnosis of autism.

CHAPTER TWO:

DESCRIPTION OF THE SAMPLE

2.1 USING THE CHAT TO IDENTIFY INFANTS AT RISK FOR AUTISM

As described in Chapter 1 (Section 1.4.3), the CHAT has been previously used prospectively to identify children with autism at the age of 18 months from a high-risk sample of siblings of children already diagnosed as autistic (Baron-Cohen et al., 1992). A recent paper describes the first use of the CHAT with a large population sample (Baron-Cohen, Swettenham, Cox, Baird, Nightingale, Morgan, Drew and Charman, 1994). The present experimental work was conducted as part of this larger project, and the sample was identified following administration of the CHAT on a total population sample of 16,000 18-month-old children. The larger epidemiological study is described in detail in Baron-Cohen et al. (1994), and the detail relevant to the identification of the experimental sample is given here¹.

2.1.1 The construction of the CHAT

As reviewed in Chapter 1, two key early-developing social-communication behaviours normally present by 18 month of age - pretend play and joint attention - have been shown to be absent or significantly impaired in school-age children with autism (see

¹ The candidate also played an equal role within the larger team in the design of the epidemiological study.

Baron-Cohen, 1993; Jarrold et al, 1993; Mundy et al., 1993; for reviews). The CHAT was designed to test for the presence of pretend play and joint attention in toddlers, on the premise that the absence of these behaviours might serve as an important prospective indicator for the early detection of autism.

The CHAT has two sections. Section A comprises questions for the parent from the clinician, whilst Section B comprises an attempt to elicit some of these behaviours by the clinician, as a check against the parental report.

Section A

The CHAT (shown in Figure 1) was constructed by including questions on the two areas of development that have been shown to absent or impaired in autism: social play and pretend play (items A4 and A5) and social interest, protodeclarative pointing and joint attention (items A2, A7 and A9). In addition, other items which have been reported to develop normally in autism were included: rough-and-tumble play, motor development, protoimperative pointing and functional play (items A1, A3, A6 and A8). All of these developmental accomplishments were expected to be easily within the ability of a normally-developing 18-month-old, as indicated by the earlier study in which more than 80% of the normal group passed all 9 items (Baron-Cohen et al., 1992).

Section B

Item Bii checks for pretend play and corresponds to item A5. Item Biv checks for protodeclarative pointing and corresponds to item A7. Items Bi and Bii record actual social interaction, but are not intended to correspond directly to particular questions in Section A. Item Bv is intended to identify general developmental or motor delay.

2.1.2 A 3-stage selection process

Although the CHAT has proved successful in identifying 18-month-old children with autism from a high-risk sample (Baron-Cohen et al., 1992), the present research was part of the first large epidemiological study to use the instrument (Baron-Cohen et al., 1994). Until the initial sample studied is followed up longitudinally, the sensitivity and specificity of the CHAT in prospectively identifying children with autism will not be known. The focus of the present research was to test for the presence of precursor abilities in a sample of young children with autism. Therefore, the following three-stage method for identifying a sample of infants with autism, and appropriate comparison groups, was adopted:

Stage One: Identifying risk groups from the total population

Following the administration of the CHAT to the whole population sample studied in the epidemiological study, three groups of children were identified, according to their scores on the key items of the CHAT. These 3 groups were not the final groups for

the experiments, simply the first way of selecting possible "at risk" subjects for the experiments.

High Risk Group 1 (Autism Risk Group)

Group 1 comprised children who failed both protodeclarative pointing and pretend play (A5, A7, Biii, and Biv). These were considered to be the autism risk group given the findings of the earlier study (Baron-Cohen et al., 1992).

High Risk Group 2 (Developmental Delay Risk Group)

These comprised children who failed protodeclarative pointing (A7 and Biv) but passed pretend play (A5 and/or Biii). These children were considered to be the "joint attention delayed" group, or the "possible language delay" group. Whilst there was no available information on the probable clinical diagnosis or prognosis of children with such a profile on the CHAT, we considered the group to be likely to consist of children who were either generally developmentally delayed or language delayed - but not autistic (Tomasello, 1988).

No Risk Group 3 (Normal Group)

Children who passed both protodeclarative pointing and pretend play items (A5, A7, Biii, and Biv). These children were expected to be developmentally normal.

Stage Two: Checking reliability of risk groups

To ensure reliability of the CHAT, children selected from each group were retested with the CHAT (CHAT-2) within 4 weeks of the first CHAT test (CHAT-1). This was to avoid children entering the experimental study (below) whose abnormalities were either extremely transient or insufficiently robust as to appear on two testing occasions. Children's second CHAT score was taken as the determining criterion for inclusion into each of the 3 groups.

Stage Three: Diagnosis of autism and developmental delay

Finally, children were allocated into 3 experimental subject groups (Autism, Developmental Delay, and Normal) for the present research by the application of standardized diagnostic and psychometric instruments. The method for the allocation of children into the 3 experimental subject groups is described next.

2.2 DIAGNOSIS OF SUBJECTS FOR THE EXPERIMENTAL STUDY

2.2.1 Diagnosing Autism

Diagnoses were made on the present sample of 20 month old children by the use of rigorous criteria using recent psychometric and clinical diagnostic scales².

Three different measures of autism were employed, and a child was allocated to the Autism Group if they met criteria on two out of these three measures. The research team was blind to the CHAT score of all children seen in the clinic for the experimental phase of the project. The 3 diagnostic measures were:

2 However, little is known about the reliability of applying these criteria to 20-month-olds, in particular the stability of diagnosis achieved at 20 months and that found at the age of 3 to 4 years, when such criteria are more commonly applied. The initial diagnoses will have to be confirmed when the present sample are followed up at age 42 months. Nevertheless, the application of standard diagnostic criteria and the multiple methods of diagnosing autism employed, ensure that the diagnosis of autism employed in the present work is of acceptable rigour, and comparable to that employed in other research in the field (Kistner and Robbins, 1986).

(i) The Autism Diagnostic Interview - Revised (ADI-R), an instrument which has been shown to have a high sensitivity and specificity (98% and 85%, respectively) in diagnosing autism (Lord, Rutter and Le Couteur, in press). This structured parental interview lasts about 90 minutes, and collects information on all aspects of development. Information is then coded into 3 independent axes: (i) Qualitative impairments in reciprocal social interaction; (ii) Verbal and non-verbal communication; and (iii) Repetitive behaviours and stereotyped patterns. If a child scores above threshold on all three axes a diagnosis of autism is given³.

(ii) In addition, a pair of experienced clinicians carried out a systematic assessment of communication skills and behaviour and made a diagnosis of autism according to established criteria (ICD-10, 1992).

(iii) Finally, another member of the research team, also an experienced clinician, rated videotapes of the experimental sessions and similarly applied ICD-10 criteria.

3 It should be noted that a slight modification was made in the present study to the application of the ADI-R threshold criterion for the third category of repetitive and stereotypic behaviour. This was because the children in the present sample were younger than those studied previously using the ADI-R, and would have had less opportunity to display some of the more developmentally-mature behaviours which are scored on this axis (e.g. circumscribed interests, verbal rituals), compared to the older ADI-R standardisation sample. Therefore, a threshold criterion score of 2 was used in place of the criterion of 3 employed by Lord et al. (in press). The threshold criteria for the other two domains were unchanged.

2.2.2 Diagnosing Developmental Delay

A measure of non-verbal mental ability was taken using the Griffiths Scale of Infant Development (Griffiths, 1986). Only the A (Motor development), D (Eye-hand coordination) and E (Performance) scales were used, since the other two scales - B (Social and self-care skills) and C (Language and communication) - confound social and language skills with non-verbal skills. A global Non-Verbal Mental Age (NVMA) score in months was calculated by taking the mean of the child's scores across the three scales.

A measure of receptive and expressive language development was taken using the Reynell Scale of Language Development (Reynell, 1985). A global language age score (LA) - expressed as a z-score to minimize floor effects of the scale since the basal language age equivalent given in the Reynell manual is 12 months - was calculated by taking the mean of the two z-scores for the receptive and expressive scales.

A child was allocated to the Developmental Delay Group if either their NVMA score was three or more months below their chronological age (CA), and/or if their LA z-score was minus 1 or less, and they had not received a diagnosis of autism. Thus, the Developmental Delay Group indicates a relatively *mild* delay in non-verbal mental development and/or language development. The mean age of the children at testing was approximately 20 months. Thus, a delay of 3 months (15%) is approximately 1 standard deviation from the mean assuming a normal distribution. Both measures of

delay are therefore set at the same level of approximately 1 standard deviation below the population mean, accounting for approximately the lowest performing 16% of the population, assuming a normal distribution.

2.2.3 The Normal Group

If a child met neither the criteria for autism, nor the criteria for developmental delay, and were free of any other clinical symptoms, they were allocated to the Normal control group.

2.3 RESULTS OF THE DIAGNOSTIC TESTS

2.3.1 Description of the total population

As reported in Baron-Cohen et al. (1994), 16,000 children were screened using the CHAT. The mean age of the whole population sample was 18.7 months (sd = 1.1 month, range = 16 to 24 months). The sex ratio was 1.05 : 1 (male : female). As measured by the current or latest occupation of the main caregiver, the social class distribution was broadly representative of the UK (Economic Activity of Great Britain, Census 1981).

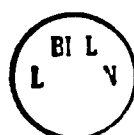
In the majority of cases (79.3%) the CHAT was administered by the family health visitor as part of the routine health surveillance screening procedure, either during a home visit or in the local clinic. In a proportion of cases (4.8%) the CHAT was

administered by the family GP, since local practice was for GPs to carry out the routine 18 month check. Finally, in another subgroup, where it was not possible to involve local health care practitioners in the survey, the CHAT was administered by the main caregiver (15.9%). CHAT scores for the whole population sample are reported in detail in Baron-Cohen et al. (1994), and are not considered further here.

2.3.2 Results from CHAT-1 and retest (CHAT-2)

As described above, the CHAT was readministered to a proportion of subjects falling into the High Risk Groups (1, 2 and 3) in order to ensure that CHAT profiles for the experimental subjects were reliable. The number of children falling into the three groups of interest at CHAT-1 and CHAT-2 are shown in Table 2.1. The issues arising from CHAT-1 to CHAT-2 discrepancies are discussed in Baron-Cohen et al. (1994). As they are not the focus of the present experimental study, they are not considered here.

All 17 children whose CHAT-2 scores placed them into High Risk Group 1 were included in the experimental sample. 17 children whose CHAT-2 scores placed them into High Risk Group 2 were also included in the sample, as were 17 children whose CHAT-2 scores placed them in (No Risk) Group 3. However, there was some attrition from the experimental sample due to non-attendance of one child from Group 1, and a failure to collect meaningful data from two children in Group 3 due them becoming upset and uncooperative during the clinic session. The final sample for the experimental phase of the project was therefore as follows:



16 children from High Risk Group 1 - failure on joint attention and pretend play
17 children from High Risk Group 2 - failure on joint attention but pass on pretend play
15 children from No Risk Group 3 - pass on both joint attention and pretend play.

2.3.3 Results of diagnostic tests

13 children (11 boys, 2 girls) met the criteria for autism as defined above; 18 children (13 boys, 5 girls) met the criteria for NVMA and/or LA delay but not autism; and 17 children (14 boys, 3 girls) met neither the criteria for autism, nor the criteria for developmental delay, and were therefore considered developmentally normal.

The correspondence of diagnostic group against classification according to retest CHAT-2 performance is shown in Table 2.2. Clearly, the correspondence between the two sets of classifications is important for a full understanding of the CHAT as a population screening instrument for autism. These issues are discussed in Baron-Cohen et al. (1994). Once again, they are not the focus of the present study, and will not be discussed further here⁴.

4 Similarly, the correspondence between the presence and absence of joint attention and pretend play as measured by the CHAT, and as measured by the detailed experimental investigation conducted in the clinic, will be of considerable importance for our understanding of the CHAT as a screening instrument, and is reported elsewhere (Baron-Cohen et al., 1994). This, however, is not the focus of the present investigation, and relationships between CHAT performance and the experimental data will not form part of the discussion of the present experimental work.

Table 2.1 The number of children from the whole population sample in Groups 1, 2 and 3 at CHAT-1 and CHAT-2.

	CHAT-1		CHAT-2	
	n	%	n	%
Group 1	73	0.5	17	0.1
Group 2	177	1.1	39	0.2*
Group 3	14064	87.9	14064	87.9*
Other	1686	10.5	1880	11.8

* Estimate based on administering CHAT-2 to half of Group 2, and a proportion of Group 3.

Table 2.2 Correspondence between CHAT-2 grouping and diagnostic classification.

Diagnostic Group	CHAT Group 1	CHAT Group 2	CHAT Group 3
Autism	11	2	-
Developmental delay	5	10	3
Normal	-	5	12

2.3.4 Descriptive data: CA, NVMA and LA

The descriptive data (CA, NVMA and LA) on all three experimental subject groups is shown in Table 2.3. In addition, the number of children in the autism and developmental delay groups who have a NVMA or LA delay above the threshold employed, are shown in Table 2.4. There were significant differences between the three groups on all three scales of the Griffiths, and the overall NVMA score, with the normal subjects having a higher NVMA than the subjects with autism and those with developmental delay (all ANOVA $p < 0.001$; see Table 2.3). Similarly, there were significant differences between the groups on both the expressive and comprehension Reynell scales, and the overall LA score, with the normal subjects scoring more highly than the other two groups of subjects (all ANOVA $p < 0.001$; see Table 2.3). Importantly, the groups of subjects with autism and those with developmental delay were matched on all NVMA and LA measures. There were no differences between any of the groups of subjects in chronological age (CA).

2.4 THE TESTING SESSION

This thesis reports the results of a series of related experiments conducted on the subject groups described above. The experiments were conducted in single session, and whilst there was no fixed order, and indeed, some tasks were conducted at different times throughout the session, the beginning and end of the testing sessions were invariant. The spontaneous/free play session reported in Chapter 4 was conducted first, in order to allow the child to acclimatize to the clinic room, and to avoid the

Table 2.3 CA, NVMA and LA for the experimental groups: Means (standard deviations).

	Autism	Developmental delay	Normal
n	13	18	17
CA	20.7 (1.4)	20.9 (1.7)	20.4 (1.0)
Griffiths A scale*	18.9 (1.3)	18.2 (1.9)	20.5 (1.1) ^a
Griffiths D scale	16.3 (2.6)	17.3 (2.4)	20.1 (1.7) ^b
Griffiths E scale	16.2 (3.0)	17.9 (3.0)	21.8 (2.8) ^c
NVMA	17.1 (1.7)	17.8 (2.0)	20.8 (1.6) ^d
Reynell comprehension*	-1.66 (0.83)	-1.53 (0.52)	0.37 (1.00) ^e
Reynell expressive	-1.75 (0.70)	-1.56 (0.68)	-0.14 (0.86) ^f
LA	-1.71 (0.72)	-1.54 (0.56)	0.11 (0.91) ^g

* Griffiths scores expressed as mental age in months

Reynell scores expressed as z-scores

a ANOVA F (2,45) = 11.0, p < 0.001

b ANOVA F (2,45) = 11.8, p < 0.001

c ANOVA F (2,45) = 15.2, p < 0.001

d ANOVA F (2,45) = 18.5, p < 0.001

e ANOVA F (2,45) = 32.1, p < 0.001

f ANOVA F (2,45) = 21.8, p < 0.001

g ANOVA F (2,45) = 29.9, p < 0.001

Post-hoc Scheffe A < N, p < 0.05; DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Post-hoc Scheffe test A, DD < N, p < 0.01

Table 2.4 NVMA and LA delay above threshold by diagnostic group.

	NVMA		LA	
	≥ 3 months delay	< 3 months delay	≤ -1 z-score	> -1 z-score
Autism	5	8	12	1
Developmental delay	8	10	16	2
Normal	-	17	-	17

"free" play being influenced by the experimenter and subsequent tasks. The empathy and attachment tasks (reported in Chapter 3) were conducted at the end of the testing session, as they carried a slight risk that the child might become minimally distressed, and it was hoped that the session would not be disrupted. In fact, very few children became distressed during these tasks, and they were quickly consoled by their parent(s).

Due to non-compliance and time problems not all children took part in all tasks. The drop-out was, however, very low and is reported for each individual task in subsequent chapters. The total testing time varied from child to child, but was usually between one-and-a-quarter hours and one-and-a-half hours. As described in each of the individual methodology sections that follow, the sessions were videotaped and analyzed subsequently.

2.5 PLAN OF THE REST THE THESIS

The following four chapters will present experimental data relevant to each of the proposed precursors briefly reviewed in Chapter 1:

- * Affective responsivity and attachment (Chapter 3)
- * Pretend play (Chapter 4)
- * Joint attention (Chapter 5)
- * Imitation (Chapter 6).

Each chapter will begin with a detailed review of the normal development, and the abnormal development in autism, of the precursor abilities concerned. Then, the results of the relevant experimental tasks will be presented. Each chapter includes an initial discussion section, which compares the results obtained with past research, and reviews the status of the candidate precursors to a theory of mind.

Chapter 7 will present data on the performance of the experimental subjects *across* the various tasks. Chapter 8 will present a summary discussion, and a full review of the implications of the present research on the status of the proposed precursors. It will also include a methodological and theoretical critique of the present work, and consider the implications for our understanding of autistic and normal development, as well as pointing towards areas for further experimental work.

CHAPTER THREE:

AFFECTIVE RESPONSIVITY:

EMPATHY, SOCIAL REFERENCING AND ATTACHMENT

3.1 THE NORMAL DEVELOPMENT OF EMPATHY, SOCIAL REFERENCING AND ATTACHMENT

Charles Darwin (1872) first argued for the universality and innateness of both the production and recognition of emotion by children, as demonstrated by the production and understanding of facial expressions. His basic premises have been borne out by experimental work carried out since the 1970s (see Ekman, 1984; for a review). During the last 25 years the development of emotional understanding and emotional responsivity has become a major field of study in developmental psychology. A review of the whole body of accumulated psychological knowledge about the development of emotion is beyond the scope of this thesis, and readers are referred to Harris (1989) and Feinman (1992) for recent reviews. The focus of the present chapter will be on the areas which have been investigated experimentally in children with autism, and which relate to the "affective" theories of the autism deficit. This includes the ability of infants to recognise and respond to emotions in others, and, secondly, the development of specific attachment relationships with caregivers.

3.1.1 Emotion recognition and response during the first six months of life

The general framework for development of emotional understanding is from *recognition* of emotions states, via *comprehension* of emotional states, to *response to* emotional states. During the first year of life an important channel through which this information is obtained is facial expression. Sherrod (1979) reviews the evidence that during the first six months of life infants are especially attentive to the various physical features of the human face. That is, its complexity, animation, configuration and association with the person's voice. By two months of age infants may apply a global scanning style in attending to faces, in contrast to the scanning of individual features when viewing other objects (Salapatek, 1975). During the third and fourth month infants differentially fixate a smiling from a non-smiling face (LaBarbera, Izard, Vietze and Parisi, 1976), and by seven months infants preferentially fixate to sound-specific combinations of facial expressions and voices (Walker-Andrews, 1986).

However, the development of recognition of facial expressions of emotion in infancy does not occur independently from responsivity to differential emotions of caregivers and others adults. There is considerable anecdotal observational evidence, and an increasing volume of experimental evidence to support the notion that two and three-month-old infants play an active role in finely tuned patterns of coordinated face-to-face interchanges with caregivers (Murray and Trevarthen, 1985; Haviland and Lelwica; see Hobson, 1993b; for a review). In these studies infants showed organized expressions of affect and attention dependent on the form and timing of the pattern of the adult's emotional expression.

3.1.2 Emotion recognition and response during the second six months of life

Several significant developmental accomplishments occur during the second six months of life: triadic joint attention behaviours, social referencing and the formation of primary attachment relationships with caregivers. These accomplishments are evidence of a relatively sophisticated understanding of some basic emotional expressions, and are also evidence of an ability to respond differently to different emotional expressions, and to different people. The study of emotional understanding and responsivity in infancy cannot be separated from the development of social relationships, particularly with primary caregiving figures. Hobson (1990b, 1993a,b) has consistently reminded other us that "isolated" accomplishments in social and cognitive development may be more clearly and accurately understood in the context of the contribution they make to the development of "social relatedness", rather than as truly isolated skills which can be used to understand others once the correct combination is in place. Joint attention behaviours (for example, the capacity to follow the gaze of other people, and the capacity to indicate and show objects to other people) form part of these behaviours, but have also been themselves proposed as possible precursors to a theory of mind. Joint attention behaviours in normal infancy and in autism are the topic of Chapter 5 and will not be discussed further here.

Hobson (1993b) follows others in defining social referencing as the infant's capacity to perceive and respond to another person's affective orientation towards objects and events in the environment (Campos and Sternberg, 1981; Feinman, 1992; Feinman and Lewis, 1983; Klinnert, Campos, Sorce, Emde and Svejda, 1983; Klinnert, Emde,

Butterfield and Campos, 1986; Walden and Ogan, 1988). This is most clearly seen in situations of ambiguity (for example, on the edge of a visual cliff, or when an unfamiliar, noisy toy is introduced), when an infant's response will be partly determined by the emotional expression shown by their caregiver. The infant is now able to not only recognize but also alter their own behaviour and understanding of objects and people in the environment by "reading off" the meaning of the adult's own response. In the second year of life young children also seem interested in the distress of others, and some children at this age show affective and prosocial responses (comforting, helping etc.) as early as the second year of life (Zahn-Waxler, Radke-Yarrow and King, 1979).

The infant's relationship with their primary caregivers also undergoes a significant change at about nine months of age. The infant shows a focused "attachment" to caregivers that entails seeking proximity and comfort from the caregivers, showing distress on separation, utilizing the attachment figure as a "secure base" from which to explore the environment, and treating strangers more warily (Ainsworth, Blehar, Waters and Wall, 1978; Bowlby, 1969/1982; Bretherton, 1985). Although individual differences exist in the responses to separation and reunion, the significance of attachment for the specific child-caregiver relationship, as well as for their current and later social relationships, is universal (Sroufe, 1986; see Bretherton and Waters, 1985; for a review).

3.2 EMPATHY, SOCIAL REFERENCING AND ATTACHMENT IN AUTISM

3.2.1 Psychogenic explanations of affective disturbance in autism

In Chapter 1 I reviewed the early psychogenic aetiological theories of autism that arose within psychoanalysis. Whilst these theories have not gained wide acceptance in the mainstream scientific community, they were influential in directing the focus of much early thinking about autism towards the affective or emotional relationship between children with autism and their parents. Unfortunately, proponents of the psychogenic cause conducted little experimental work amongst the population with autism as a whole, and their evidence was mostly drawn from anecdotal clinical descriptions of pathological features of the relationships between the children with autism referred to their clinics, and their parents. The types of emotional, or affective, disturbances they described included: the child perceiving the social environment as traumatic and uncontrollable due to parental rejection (Bettleheim, 1967), a basic fear of social contact (Tinbergen and Tinbergen, 1983), and autistic withdrawal as a response to the traumatic stress of bodily separation from the mother, chronically affecting the development of object relations (Tustin, 1991, 1994). However, more recently aspects of the social and emotional development of children with autism have been investigated experimentally, and those aspects relevant to the present research will be reviewed next.

3.2.2 Social referencing and empathy in autism

Social referencing involves a "triangulation of relatedness" (Hobson, 1993b) between the infant, the object or event in the environment, and the *meaning* communicated by the caregiver (or other adult) about the event or object. As indicated above, this involves elements in common with joint attention behaviours (whether the meaning or message is communicated visually or auditorily) as well as the unique elements of "reading" and "responding" to the message communicated. Although it is not possible to separate fully these overlapping, the joint attention aspects will be covered separately in Chapter 5, and the unique elements which involve reading and response to the emotional meaning communicated will be the focus here.

Dawson et al. (1990) studied the face-to-face interactions of preschool-aged children with autism and their mothers during free play, as well as during more structured situations involving tidying up toys and snack time. They found that, in comparison to a sample of normal children matched for receptive language ability, the children with autism were less likely to combine smiles with eye contact (i.e. expressive social referencing) and were less likely to smile in response to smiles from their mothers. Although the study found no overall differences in the amount of eye contact or smiles between the two groups, the children with autism appeared to share and coordinate affective states less than the comparison group. This lack of coordination of affective response (smiles) and joint attention (eye contact) has also been found in other similar experimental studies by Yirmiya et al. (1989) and Snow, Hertzog and Shapiro (1987). However, in contrast to the findings of Dawson et al. (1990), both of

these other studies found that children with autism expressed less positive affect overall. Yirmiya et al. (1989) summarize the close interrelationships between these elements as follows:

"The causal direction between interpreting and expressing feeling states, on the one hand, and sharing feeling states, on the other, is difficult to determine. Rather, it may be that these three abilities are in continuous transaction, each contributing to, and influencing, the development of the other two." (Yirmiya et al., 1989; p. 733)

Sigman et al. (1992) directly tested empathic response and social referencing behaviours in a group of four-year-old children with autism, and in mental handicap and normal controls. In one experiment which tapped into elements of both empathic response to an adult's distress (showing concern at another's distress) and social referencing (reading the meaning of the message communicated about an object), an adult pretended to hurt themselves by hitting their finger with a hammer. The children with autism often appeared unconcerned (lack of empathic response) and continued to play with the toy (failure to read a negative message about the "dangerous" toy). This experimental design is used in the present study and will be described in more detail below (Section 3.4.1).

In related experiments the adult experimenters simulated fear towards a remote-controlled robot, and pretended to be ill by lying down on a couch, feigning discomfort. Again, only the autistic group failed to show empathic responses and

appeared unconcerned and continued to play with the toy. Sigman and Kasari (Kasari, Sigman, Baumgartner and Stipek, 1993) have also shown that whilst children with autism will smile when they have completed a puzzle (demonstrating pleasure in "mastery" in completing the task), they do not look up to an adult to draw attention to what they had done (demonstrating a desire to share a sense of "pride" in completing the task).

Whilst, these experiments do not allow us to fully separate a possible joint attention deficit from a deficit in sharing the emotional meaning of social referencing, or empathic communication, they do fit with the common clinical and anecdotal descriptions of the core autistic deficit. Children with autism appear not to be interested in the emotional responses of others, and do not communicate their emotional appraisal or response to situations to others.

3.2.3 Attachment in autism

A disturbance in interpersonal relationships forms part of the defining diagnostic criteria of autism. DSM-III-R (APA, 1987) states that the disturbance in reciprocal social interactions is:

"characterized by failure to develop interpersonal relationships....adults may be treated as interchangeable, or the child may cling mechanically to a specific person. The attachment of some toddlers to their parents(s) may be bizarre..."
(DSM-III-R/APA, 1987; p. 34)

However, this does not mean that children with autism form no specific attachments at all. The experimental work which has been conducted has demonstrated that children with autism *do* show some attachment behaviours, but that rather the qualitative nature of their attachment relationships overall is disturbed. Several studies have utilised the classic "strange situation" (Ainsworth et al., 1978) which involves a number of separation and reunions, in the presence of a stranger, to measure the quality of the attachment relationship that exist between the child and their caregiver (usually the mother) (Capps, Sigman and Mundy, 1994; Rogers et al., 1991; Shapiro et al., 1987; Sigman and Mundy, 1989; Sigman and Ungerer, 1984a). The isolated attachment behaviours which have been shown to be relatively intact in the autistic samples studied include: variable reactions to caregiver and strangers, some distress or fretting on separation, and proximity-seeking on reunion. Some authors have categorized their samples according to the standard attachment classification, and have found substantial numbers of children with autism to be "securely attached" (Capps et al., 1994; Rogers et al., 1991; Shapiro et al., 1987). Whilst Shapiro et al. (1987) found no relationship between security of attachment and developmental quotient, Rogers et al. (1991) found that for the children with autism only security of attachment was related to language development, and there was a trend towards a relationship with chronological age and mental age. They suggest that attachment formation may involve different processes in autistic children than in nonautistic children of equivalent intellectual level, possibly because of the cognitive demands of constructing an "internal working model" of the attachment figure (Bowlby, 1969/1982, Main, 1991) in the absence of the normally-available affective understanding.

However, as Hobson (1993b) points out, the strange situation experimental paradigm should not be taken as a complete measure of attachment relationships, and there is strong evidence that attachment relationships do not develop normally in children with autism:

"...there are important respects in which autistic children do *not* relate to their parents normally. They often do not turn to their parents for comfort, they do not seem interested in sharing things and experiences, and they seldom seem to show a normal quality of caring towards these significant other people" (Hobson, 1993b; p. 75)

3.3 AFFECTIVE RESPONSIVITY AS A PRECURSOR TO A THEORY OF MIND

3.3.1 Affective interpersonal relatedness as a precursor to a theory of mind

Hobson (1984) first proposed that the characteristic profile of impairments in children with autism is due to their failure to fully develop a concept of persons. In a series of experimental and theoretical papers Hobson has refined his theory and clarified its position with regard to competing theories of the autistic deficit (Hobson, 1984; 1986a,b; 1989a,b; 1990a,b,c; 1991b; 1993a,b). These papers form the basis of the argument put forward in this section, and I shall largely draw upon the summaries of his position which Hobson provides in a recent chapter (1993a) and in a recently published book (1993b).

Hobson (1990b,c; 1993a,b) has argued that children with autism fail to develop an adequate concept of persons because of an impairment in biologically-based capacities for engaging in personal relatedness, especially affective relatedness. Following Stern (1985) and Trevarthen (1979), Hobson argues that it is through "primary intersubjectivity" (also called reciprocal personal relatedness) that the infant differentiates persons from things, and embarks on a line of development towards more explicit understandings of the mental life of self and other people. Hobson (1993b) goes on to argue that this affective deficit will cause the impairments seen in pretence and joint-attention behaviours, as well as face- and emotion-recognition deficits, and, in time, the development of a theory of mind.

For Hobson, the fundamental abilities and propensities which children with autism lack are "perceptual-affective" and are innate, or "prewired", in normal infants and young children. In discussing the role of these basic perceptual-affective abilities and propensities in the normal course of development, Hobson (1993a) summarises his early thinking as follows:

"I had become convinced that in order to acquire knowledge of the nature of persons with minds, an individual needs to have experience of reciprocal, affectively-patterned relations with others; and in order to become engaged in personal relations, an individual needs to perceive and react to the bodily appearances, expressions, and actions of others with what philosophers have called "natural" reactions involving feelings." (Hobson, 1993a; p. 205)

Hobson conceives of an individual's understanding of minds as inherently *interpersonal*, in that mindfulness is attributed both to self and to others (Hobson, 1993a). However, he argues against the notion suggested by the simulationist position (Harris, 1991) that an infant first conceptualises their own mental life and then transfers or projects the concepts acquired to other people, thereby acquiring the notion that other people have similar minds too (Hobson, 1990c; 1991b). He follows Mead's (1934) lead in stating that a child's capacity for reflective self-awareness emerges only when the child can recognize the other to be a person with whom she can identify, as compared to a non-person object. That is, the child requires separate mechanisms for perceiving and acting towards "persons" and "things" (Hobson, 1993b) - or as Hobson puts it *personal relatedness* and *thing relatedness*.

Theories which have emphasized the preeminence of the child's cognitive development in the eventual acquisition of a theory of mind, argue that certain cognitive concepts about bodies and minds must be in place before they can be applied to other people (Leslie, 1987; Leslie and Frith, 1990). Hobson's position, following the philosophical line put forward by Strawson (1962), is that the concept of "person" is more primitive than the concept of either "mind" or "body". Similarly, for Hobson, affective relatedness is an innate part of the human condition, which does not wholly depend on cognitive development and maturation for its existence (see also Tomasello, Kruger and Ratner, 1993). Hobson (1993a) summarizes his notion of affective relatedness as follows:

"One organism can perceive and relate to the "body" of another with highly

configured patterns of feeling and action that correspond with the feelings and actions of the other. One organism can also perceive something of the outer-directedness of the psychological attitudes of another in the other's behaviour. It is not the case that to begin with, behaviour is perceived in a cool, detached way, and is only subsequently interpreted as "mental"; nor does the idea of subjective mental life "behind" behaviour come from nowhere." (Hobson, 1993a; p. 214)

He cites many early social-affective developments, reviewed above in Section 3.1, such as face recognition, empathy and social referencing, as evidence of such prewired affective relatedness in infancy. In autism he suggests that early and severe impairments in such interpersonal-affective relatedness abilities and predispositions constrain the child's understanding of persons and of minds, leading to the characteristic profile of affective and cognitive deficits. Mundy et al. (1993) put forward a related thesis to that of Hobson, arguing that joint attention deficits, which involve early-developing affective and interpersonal abilities and propensities, underlie the later impairments in the development of a theory of mind. (The joint attention precursor hypothesis is the topic of Chapter 5 and the work of Mundy and Sigman, and their colleagues, will be reviewed in detail there).

In support of his theory Hobson (1993a) cites the clinical evidence of the lack of affective, as well as the social, contact when with children with autism. Hobson also cites the high prevalence of echolalia, personal pronoun difficulties, deficits in symbolic play and problems with sharing shown by congenitally blind children

(Fraiberg and Adelson, 1977; Mulford, 1983). He argues that these characteristics arise due to the paucity of visually-derived sources of information available to such children. However, such clinical observations have yet to be confirmed by empirical investigation.

In a series of experiments Hobson and his colleagues have demonstrated autism-specific deficits in several aspects of the perception of and response to facial expressions. Weeks and Hobson (1987) found that whereas non-autistic children tended to sort piles of photographs by facial expression, children with autism tended to sort by non-facial features, such as clothing. In further experiments, children with autism were poor at matching facial expressions with bodily gestures (Hobson, 1986a, b; Hobson, Ousten and Lee, 1988a,b; 1989). However, replications of this work have produced discrepant results, particularly when the autism and control groups have been matched on mental age (Macdonald, Rutter, Howlin, Rios, Le Couteur, Evered and Folstein, 1989; Ozonoff et al. 1990; Tantam et al., 1989), and it appears that emotion-recognition and emotion-coordination deficits are not specific to autism (Baron-Cohen, 1993).

3.3.2 Attachment as a precursor to a theory of mind

In a related theory to that put forward by Hobson, Fonagy and colleagues (Fonagy, 1991; 1993; Fonagy and Higgitt, 1990; Fonagy and Moran, 1991; Fonagy, Steele and Steele, 1991; Fonagy et al., 1991) have proposed that the development of the *reflective self*, the internal observer of mental life, is a direct precursor of the later development

of a theory of mind. Drawing on psychoanalytic theory (A. Freud, 1965; 1970) Fonagy distinguishes between the *prereflective self*, which is the immediate and unmediated experiencer of life, and the *reflective self*. The latter reflects upon mental experience, conscious or unconscious, and is aware that its representations of its behaviour and actions are shaped by the content of other's mentation. In common with Hobson's theory (1993a,b), for Fonagy et al. (1991a,b) the evolution of awareness of mental processes in the self and other are intrinsically linked.

Three strands of evidence are presented to back up these ideas. First, Fonagy et al. (1991a,b) cite the case of autism, arguing that an incapacity to reflect on mental experiences underlies the communicative and emotional impairments found in autism. Second, in their work with "borderline" adult patients Fonagy and Higgitt (Fonagy, 1993; Fonagy and Higgitt, 1990) have argued that primitive modes of thought, including a lack of self-reflective capacity, part-object relatedness, and concrete thinking, are linked to their incapacity to understand that others have minds. The third strand of evidence is that the effect of a lack of a reflective self can be transgenerationally transmitted. Fonagy et al. (1991a,b) found a strong relationship between the reflective-self functioning of the mother before a child was born and the child's security of attachment to the mother at age 12 and 18 months. The caregiver's ability to "mentalize" is held to be an important prerequisite for normal object relations. The argument goes as follows: If the parents are unable to react empathically to the infant, the infant's ability to attune to the feelings of others will be impaired, as will its comprehension of its own and other's mental states. Fonagy et al. (1991a,b) state that as the attachment relationship between a child and their mother is an

indicator of both their own developing reflective self, and indirectly of the reflective self-functioning of the mother, the nature of the attachment relationship between a child and their mother (or other caregiver) should directly influence the child's later development of a theory of mind.

3.4 EXPERIMENT 1

Two tasks measuring different aspects of affective responsivity were conducted. First, a task measuring the child's response to the expression of negative emotions by others; and second, a single separation-reunion episode to provide measures of specific child-mother attachment behaviours.

3.4.1 Empathy task

Method

One of the measures of response to the negative affect of others devised by Sigman et al. (1992) was employed. The experimenter played jointly with the child, with a plastic pounding toy and hammer. During this joint play the experimenter pretended to hurt themselves by hitting their thumb with the hammer. For 10 seconds the experimenter displayed facial and vocal expressions of distress (i.e. cries of pain), without using words, and stopped touching the toy. After a 10 second period of neutral affect the experimenter showed the child that their finger did not hurt any more, and they resumed playing with the toy. 2 independent judges checked that the

experimenter's simulation of painful expression and vocalisation was realistic.

Scoring

The episode was videotaped, and the following measures were scored as either present or absent from the film for the 10 seconds during which the experimenter was displaying distress:

1. Whether child looked at adult's face
2. Whether child looked at adult's hand
3. Whether child made a move to help adult
4. Whether child continued to touch or play with the toy.

In addition, the child's own facial affect was coded as follows:

- (a) Worried/concerned/upset (e.g. intense concentration, tight lips, frown)
- (b) Indifferent/neutral
- (c) Positive (e.g. smiles, eyebrow lifts, bright, expectant, pleasant expression).

Thus, measures were taken of social referencing behaviour (look to adult's face), "instrumental" behaviour (look to adult's hand), empathic response (child's affect and child moves to help), and social referencing affecting the child's behaviour (child stops playing with, or touching, toy).

Inter-rater reliability

17 of the empathy trials were rated by a second rater across all five measures taken. The inter-rater reliabilities for the empathy measures, expressed in terms of percentage agreement, and as measured by Cohen's kappa (Cohen, 1960), are shown in Table 3.1. Across all 5 measures, the mean agreement measured in percentage terms was 93% (range 88% to 100%), and as measured by kappa 0.85 (range 0.76 to 1.00).

3.4.2 Attachment behaviour in the "Separation-Reunion" paradigm

Method

Previous work by Sigman and Ungerer (1984a), and Sigman and Mundy (1989), had demonstrated that some children with autism do show basic attachment behaviours, such as distress on separation, and proximity-seeking on reunion. At the close of the testing session, a shortened separation-reunion episode (involving only one separation and one reunion), based on Sigman's earlier work (Sigman and Mundy, 1989; Sigman and Ungerer, 1984a), was conducted in order to elicit some specific child-mother attachment behaviours. If people other than the child's mother had been present during the testing session (in some cases the father or a sibling were present for part or whole of the session), they were asked to leave a few minutes before the separation period began. The child was engaged in solitary play with a toy. Their mother then exited, leaving the child in the room with the experimenters. After a separation of one minute, the mother was asked to return to the room. When the caregiver returned they were

asked to shut the door, and to sit on chair as before, responding appropriately to their child's advances, but not to directly approach the child or initiate interaction with the child. If a child showed distress during the separation period for 15 seconds continuously, the mother was called in immediately, and the episode was terminated.

Scoring

A video was made of the child's behaviour during the 1 minute separation period, and for the 1 minute reunion. From the video, the following behaviours were scored as either present or absent:

(i) During separation:

1. Did the child notice mother leaving the room?
2. Was the child distressed?
3. Did the episode have to be terminated early?

(ii) During reunion:

1. Did the child look at mother?
2. Did the child touch mother?
3. Did the child seek proximity to mother?

Inter-rater reliability

10 of the attachment trials were rated by a second rater across all six measures taken.

The inter-rater reliabilities for the attachment measures, expressed in terms of percentage agreement, and as measured by Cohen's kappa (Cohen, 1960), are shown in Table 3.1. Across all 6 measures, the mean agreement measured in percentage terms was 95% (range 80% to 100%), and as measured by kappa 0.89 (range 0.60 to 1.00).

3.5 RESULTS

3.5.1 Empathy task

On the single episode empathy task the presence or absence of the key behaviours was scored from the videotapes. The results are summarised in Table 3.2. All subjects took part in the empathy trial except for one child with autism. Only one child actively moved to comfort the experimenter, and this variable was excluded from the analysis.

Non-parametric analysis demonstrated that the children in the developmental delay and normal groups looked to the experimenter's face more ($X^2 = 18.5$, $p < 0.001$; Fisher's exact: A x DD $p < 0.003$; A x N $p < 0.003$; DD x N = ns), and were more likely to be rated as showing facial concern ($X^2 = 15.4$, $p < 0.005$; Fisher's exact: A x DD $p < 0.05$; A x N $p < 0.003$; DD x N = ns), than the children with autism. There was a non-significant trend towards children with autism continuing to touch the toy more ($X^2 = 5.2$, $p < 0.08$). There was no difference in the frequency with which the groups looked to the experimenter's "injured" hand. Post-hoc comparisons comparing the mean CA, NVMA, and LA of the children in each group who looked to the

Table 3.1 Inter-rater reliability for empathy and attachment measures

	Percentage agreement	Kappa
Empathy measures		
Look to adult	100	1.00
Look to hand	88	0.76
Move to help	*	*
Continue to touch toy	88	0.76
Affect	94	0.88
Attachment measures		
Notice mother leave	100	1.00
Distressed	90	0.73
Episode terminated	100	1.00
Look at mother	80	0.60
Touch mother	100	1.00
Seek proximity	100	1.00

* insufficient variance to calculate kappa

experimenter's face, and those who did not; as well as those who showed, or failed to show, facial concern, were conducted. Due to the multiple comparisons this involved, a conservative level of significance of $p < 0.01$ was adopted, in order to minimise the risk of false positives, or Type I errors. None of the analyses reached significance, indicating that within each group the children who produced the key behaviours did not have a greater mean CA, NVMA or LA than those who did not.

3.5.2 Attachment task

Following the separation-reunion episode, the presence or absence of the key behaviours was scored from the videotapes. The results are summarised in Table 3.3. One subject from the autism group, and 5 subjects from the developmental delay group, did not take part in the attachment task. The task was conducted at the close of the testing session, which sometimes lasted up to an hour-and-a-half, and non-participation was due to both non-compliance (including one child falling asleep) and time constraints.

Non-parametric analysis demonstrated significant differences in only two of the key behaviours: children in the normal group were more likely than children with autism to notice their mother's departure from the room ($X^2 = 9.87$ $p < 0.008$; Fisher's exact: A x DD = ns; A x N $p < 0.005$; DD x N = ns), and children from both the normal and the developmental delay groups were more likely than children with autism to

Table 3.2 Percent of children who produced the key behaviours on the empathy task.

	Look face	Look hand	Continue to touch toy	Show facial concern
Autism n = 12	53.8%	30.7%	83.4%	8.3%
Developmental delay n = 13	100%	50.0%	55.6%	44.4%
Normal n = 17	100% ⁺	42.9%	41.2% [*]	64.7% [#]

⁺ $\chi^2 = 18.5$ $p < 0.001$ [Fisher's exact: A x DD $p < 0.003$; A x N $p < 0.003$; DD x N = ns]
^{*} $\chi^2 = 5.20$ $p < 0.08$
[#] $\chi^2 = 15.4$ $p < 0.005$ [Fisher's exact: A x DD $p < 0.05$; A x N $p < 0.003$; DD x N = ns]

look towards their mother during the first minute of the reunion ($X^2 = 19.2$, $p < 0.001$; Fisher's exact: A x DD $p < 0.003$; A x N $p < 0.001$; DD x N = ns). Very few children in any of the groups showed distress, and only one episode was terminated due to persistent distress. There were no significant differences in other reunion measures of touching mother, and proximity-to-mother seeking. Post-hoc comparisons comparing the mean CA, NVMA, and LA of the children in each group who noticed mother's departure, and those who did not; as well as those who looked to mother on reunion, and those who did not, were conducted. Again, a conservative level of significance of $p < 0.01$ was adopted. None of the analyses reached significance, indicating that within each group the children who produced the key behaviours did not have a greater mean CA, NVMA or LA than those who did not.

3.6 DISCUSSION

3.6.1 Empathy task

The empathy task measured two aspects of empathic and social response. First, on the direct measure of empathic response - expressing facial concern - the children with autism showed impaired empathic response to the distress of the experimenter, compared to both developmental delay and normal controls. Whilst approximately half and two thirds of the developmental and normal controls, respectively, were rated as showing facial concern, only one child with autism was rated as doing so. On the measure of look to experimenter's face, there was also an autism-specific impairment. Whilst all of the children in both control groups looked to the experimenter's face,

Table 3.3 Percent of children who produced the key behaviours on the attachment task.

	Notice departure	Distress	Look reunion	Touch reunion	Proximity reunion
Autism n = 12	41.7%	8.3%	16.7%	16.7%	16.7%
Develop. delay n = 13	78.6%	14.3%	78.6%	28.6%	35.7%
Normal n = 17	93.8% ⁺	25.0%	93.3% [*]	46.7%	40.0%
<hr/>					
+ $X^2 = 9.87$	p < 0.008	[Fisher's exact: A x DD = ns; A x N p < 0.005; DD x N = ns]			
* $X^2 = 19.2$	p < 0.001	[Fisher's exact: A x DD p < 0.003; A x N p < 0.001; DD x N = ns]			

only half of the children with autism did so. However, on the control measure which assessed looks to the experimenter's hand - designed to measure an instrumental response to the incident - there were no group differences. Hence, there is no indication that the children with autism looked less overall, rather that they specifically produced fewer *social* looks.

On the measure of social referencing (the child's capacity to perceive and respond to another person's affective orientation towards objects or events - see Section 3.2.2) - whether the child stopped playing with the toy following the experimenter's distress - there was a non-significant trend towards the children with autism producing less social referencing behaviour. On none of the measures were there significant relationships with CA, NVMA or LA.

The present results are similar to those obtained by Sigman et al.'s (1992) original study which used the same "injured thumb" scenario for measured empathic response to the distress of others with older children with autism (Experiment 1). Sigman et al. (1992) found that children with autism looked to the experimenter for less time and continued playing with the toy more, as well as the presence of little active comforting behaviour in all three experimental groups. However, in contrast to the present results, whilst children with autism received a less positive overall empathy rating in Sigman et al.'s (1992) study, they did not find a specific difference in the rating of facial concern. Also similar to the present findings, Sigman et al. (1992) found no relationship between task performance and CA or MA measures. In another related study which assessed the emotional understanding and empathic response of older

high-functioning children with autism to segments of videotaped stories, whilst the children with autism showed what the authors describe as a surprising level of intact empathic abilities, they still performed significantly below the control groups (Yirmiya et al., 1992). However, in this study there were clear relationships between measures of cognitive ability and affective understanding and response.

How should the present results be interpreted? The findings of a lack of empathic response fit with the common diagnostic picture presented by children with autism (DSM-III-R/APA, 1987). In contrast to normal children (Camras and Sachs, 1991; Klinnert et al., 1986), and children with a developmental delay, children with autism appear to be uninterested, or may not recognize the emotional reactions of others (Hobson, 1986a,b; MacDonald et al., 1989). Obviously, this would seriously hamper the opportunities they have for learning about the social world.

The finding that some type of looking was found to be intact in the experimental situation (looking to the experimenter's "injured" hand) rules out that children with autism simply avoid looking at people. Previous findings also show that children with autism do not look less to faces overall, but use gaze in less social and communicative ways (Dawson et al., 1990; Mundy et al., 1993; Sigman, Ungerer, Mundy and Sherman, 1986), and similarly, do not differ from controls in their absolute production of facial affect (Dawson et al., 1990; Kasari et al., 1990; Yirmiya et al., 1989), but only in the coordination of displays of affect with joint attention behaviours (Dawson et al., 1990; Snow et al., 1987).

One possible explanation for the present results is the argument that the empathy task is merely another measure of joint attention, and does not measure aspects of emotional understanding or response. Two theoretical criticisms rule this out. First, the look to adult when displaying distress in the present experimental set-up does not involve the *triangulation* between two agents and an object or event, considered essential for joint attention (Baron-Cohen, 1994; Butterworth, 1991). Secondly, neither the measure of facial concern, nor that of social referencing, directly involve joint visual attention. In addition, the within-group correlations between measures of empathic response and performance on the joint attention tasks were low (see Section 7.1). In summary, whilst the experiment does involve gaze behaviour, it does not merely replicate the joint attention tasks described in Chapter 5, but measures separable aspects of social and emotional understanding of behaviour which were specifically impaired in the children with autism.

Certainly, at the age of 20 months most children with autism appear to be significantly impaired in their interest in, and particularly their response to, emotional distress in unfamiliar adults. Hobson (1993a,b) argues that such findings would be expected since children with autism do not have the innate abilities and propensities for personal relatedness, specifically affective relatedness, with others. Such capacities were demonstrated by all the controls in the present experiment, and have been shown in other studies early in the second year of life (Rheingold, Hay and West, 1976; Zahn-Waxler and Radke-Yarrow, 1990). Although half the children with autism did produce one relevant behaviour - look to adult - this may reflect either an interest in the distress of others, or be a more instrumental investigation of a salient and unexpected

stimulus (the experimenter screaming in "pain"). On the measures which tapped empathic response, performance in the autism group was near floor - only one child was rated as showing facial concern, and only two (out of the total group of 13 children) showed intact social referencing by stopping playing with the toy, thereby interpreting the distress of the experimenter as being meaningful about the outside world.

Sigman et al. (1992) propose that children with autism lack the cognitive or affective underpinnings to interpret and therefore understand the emotions of others. The present study by itself does not allow us to decide whether the fundamental deficit is affective or cognitive. However, the findings with older more able children and adolescents (Yirmiya et al., 1992) suggest that higher levels of cognitive functioning may aid at least some children with autism to compensate for their impairments. Therefore, a basic level of emotional understanding may be achieved in some children with autism (usually "high functioning" or Asperger's syndrome) by an alternative developmental route than that for normally developing children, and children with a mental handicap but without autism. This alternative route may only be accessible to older and more able children with autism. Such an argument is advanced by Leslie and Thaiss (1992) for those older and more able children with autism who pass false belief tasks.

3.6.2 Attachment task

The separation-reunion paradigm produced mixed results, with the children with autism producing less of some attachment behaviours - noticing mother's departure

(compared to normal children only) and looking to mother on reunion (compared to both control groups); and no group differences on others - distress on separation, touch mother and proximity-seeking on reunion. Thus, some attachment behaviours were found to be relatively intact in the sample of children with autism. Even on one measure where impairments were found, over 40% of the children with autism produced the key behaviour of noticing mother's departure. However, whilst these specific attachment behaviours can be seen as the observable building-blocks of an attachment relationship, they do not constitute a measure of security of attachment. This will affect our ability to directly compare the present results to those of other studies and to interpret them within the precursor framework adopted throughout the present thesis. These methodological criticisms are addressed in more detail below.

If we leave aside the differences in looking behaviour, we can conclude that, as in other studies, attachment is present in autism. In the studies whose measures of discrete behaviours was closest to that employed in the present study, Sigman and others (Sigman and Mundy, 1989; Sigman and Ungerer, 1984a) found no significant differences between children with autism and children with a mental handicap but without autism. The authors conclude that at the very basic level of measuring attachment - i.e. preferentially directing social behaviour to caregivers rather than to strangers, especially after separation, children with autism do not differ from controls. Similarly, with the exception of looking behaviour, the present pattern of results suggests that at least at this basic level of demonstrable preferential behaviours there is no autism-specific impairment.

Other studies have measured security of attachment according to the 5-point schedule for older children, based on the original classification system of Ainsworth et al. (1978). Rogers et al. (1991), Shapiro et al. (1987) and Capps et al. (1994) have previously found that children with autism did produce appropriate attachment behaviour in response to separation-reunion episodes (distress on separation, proximity seeking on reunion etc.), and that some children with autism were classified as securely attached. Thus in the three existing studies which not only measured specific, discrete attachment behaviours but also rated the relative security attachment of children with autism, none of the differences reported in the present research were apparent. Unfortunately, since neither Shapiro et al. (1987) nor Rogers et al. (1991) provide data on individual behaviours, such as those measured in the present study, and since the present study made no attempt to rate security of attachment, these studies are not directly comparable. Several of the studies have examined the relationships between attachment behaviours, or attachment security, and development variables. In line with the present results, neither Sigman and Mundy (1986), Sigman and Ungerer (1984), nor Shapiro et al. (1987) found relationships between attachment measures and CA, LA or development quotient.

Of interest, is the finding by Rogers et al. (1991) that security of attachment in children with autism was positively related to cognitive and language measures, and a recent similar relationship between secure attachment and language ability were reported by Capps et al. (1994). No such relationships were found for the nonautistic controls. Rogers et al. (1991) suggest that the construction of an internal working model (Bowlby, 1969/1982, 1980) may be more difficult for the children with autism.

They suggest that this provides support for Hobson's (1989) notion that emotional perception and expression deficits may weaken the affective data base the child which children with autism have at their disposal concerning their mother. In order to construct the internal working model on which a secure attachment relationship is based the autistic child, with a paucity of affective and intersubjective information, has a more difficult cognitive task than other children.

3.6.3 Implications for the status of affective responsivity as a precursor to a theory of mind

How do the present and past results fit together and what do they say about the status of empathy and attachment as a precursor to the development of a theory of mind? To reiterate an earlier point, in this thesis the research strategy does not allow us to confirm that a particular domain conclusively is a precursor to theory of mind, but it does allow us to conclusively rule out that it is not a precursor to theory of mind. If the specific domain is unimpaired, then it cannot be a precursor to theory of mind. The present findings suggest that attachment is unlikely to act as a developmental precursor to a theory of mind, but empathic responsivity might. In the next chapter, a test of the second putative precursor, pretend play, is reported.

CHAPTER FOUR:

PRETEND PLAY

4.1 THE DEVELOPMENT OF PRETEND PLAY

4.1.1 Early thinking about pretence

The history of pretend play in developmental psychology can be divided across the temporal watershed of pre- and post-theory of mind research. Conceptual analysis of play before the 1980s was dominated by Piaget's (1962) work, and experimental work of researchers such as Lowe (1975) and Fein (1981). Since that time, the inclusion of considerations about the child's developing theory of mind have significantly changed our conceptual understanding of pretence (Harris, 1993; Harris and Kavanaugh, 1993; Leslie, 1987). Alongside these changes has been the growing importance of the developmental psychopathological perspective (Cicchetti, 1984), provided by experimental work on the production of pretend play by children with autism (Baron-Cohen, 1987; Harris, 1993; Jarrold et al., 1993; Lewis and Boucher, 1988; Ungerer and Sigman, 1981). However, in order to provide a thorough introduction to this area, a brief overview of the research prior to these recent developments will be given.

Early work on the emergence of play in children concentrated on the role of play as an index of the child's emotional state (Sears, 1947), and drew on ideas from

psychoanalysis. Play was not studied as an index of the child's developing cognitive capacities and underlying mental structure until the rise of a more cognitivist developmental psychology, principally due to the independent work of Piaget (1962) and Vygotsky (1967). Piaget (1962) characterized play in early infancy as the exercise of the child's developing functions, irrespective of the nature of the material handled. In the second year of life a new type of play is seen to emerge, "pretend" or "symbolic" play. This presupposes that the child's actions have acquired meaning in relation to the objects around him, and that further s/he is developing the ability to represent an absent object or experience by means of his/her own actions, usually with the aid of objects that resemble the represented content to a greater or lesser degree. Piaget (1962) assessed these developments as significant, in part because they occur at the same time as the emergence of verbal language. He characterised both developments as manifestations of the same representative or semiotic function. Similarly, Lunzer (1959) had earlier stressed the close relationship between symbolic play and language, noting that "the cognitive functions of play and language are essentially similar" (Hulme and Lunzer, 1966; p. 108).

According to Piaget, progressive developmental changes occur during the second and third year of life, with respect to (i) decontextualization of behaviour, (ii) the sequential combination of behavioural elements, (iii) a shift from self- to other-referencing, and (iv) the substitution of one object for another. In the third year of life, sociodramatic play emerges, increasingly replacing the solitary symbolic activity of the sensorimotor period (Piaget, 1962). However, the present review will concentrate on solitary non-social play acts, since these are the focus of the experimental work

presented later in this chapter.

When pretence appears, at about 12 months, it is self-referenced (e.g. the child pretends to feed itself) and it is not until around 18 months that such acts become other-referenced (e.g. the child pretends to feed mother or a doll) (Fein and Apfel, 1979; Lowe, 1975). Increasingly, the child treats the doll less as a passive recipient of the child's action and more as an active manipulator of objects (Lowe, 1975; Watson and Fischer, 1977). Another important development in pretend play in infancy is the child's increasing ability to substitute one object with another (Piaget, 1962). Watson and Fischer (1977) demonstrated that infants' use of a realistic doll increased between 14 and 19 months. By contrast, use of a substitute block is fleeting at this age, but increases rapidly between 19 and 24 months. For Piaget, substitution behaviour reflects the development of representational thought but of itself serves no special role in the acquisition of operational processes (Piaget, 1966). For Vygotsky (1967), substitution behaviour has a more crucial, active role in the development of language. Although the substitute object must initially resemble the real object, the requirement of resemblance is gradually reduced as the "meaning" becomes detached from immediate, external stimulation. The substitute object serves as a "pivot" object, precipitating the shift from "things as objects of action" to "things as objects of thought". Jarrold et al. (1993) summarise Vygotsky's position thus: "play is a vehicle for developing intention and for internalizing thought by the emancipation of meaning from action and from objects". (p. 282)

4.1.2 A note on terminology and definitions

There has been variability in the terminology employed to describe qualitatively different types of play, and in the rigour with which definitional criteria for pretence are employed. The terms "pretend" and "symbolic" play have been used interchangeably by different experimenters to describe pretence. The present thesis will use the word "pretend", although "symbolic" will be used when citing work of researchers who have chosen to use that term. The concern is to define "pretend" play, as distinct from "reality" play. The difficulty in imputing mental operations from observed behaviour is the source of considerable confusion in the precise definition of pretence. Symbolic or pretend play is behaviour that is simulative or nonliteral (Fein, 1981), acting *as if* something is the case when it is not (Leslie, 1987; Reynolds, 1976). One important quality of such a cognitive operation is that the person must simultaneously know both the real situation (e.g. what the object actually is) and the pretend situation (e.g. what the object is now represented as being). Such simultaneous representation, or "double knowledge", ensure that the person is pretending rather than being simply mistaken or confused (Leslie, 1987).

A rigorous definition of pretence was proposed by Leslie (1987). Leslie (1987) based his definition on the relation of the *logical properties* of mental states and the logical properties of pretending. He identified these as:

1. Deviant reference, in which objects are substituted for one another
2. Deviant truth, in which false properties are attributed to objects

3. Deviant existence, in which absent objects are present.

On Leslie's view, the three forms of pretend play that relate to these logical properties are:

1. Object substitution (e.g. "this banana is a telephone")
2. Attribution of false properties (e.g. "this doll's face is dirty")
3. Attribution of presence to imaginary objects (e.g. "this [empty] cup is full of tea").

Lillard (1993a) has more recently offered a further definition of pretence, which in common with Leslie (1987), is explicit about the necessity for pretending to be done knowingly and intentionally:

"There are five features that could be considered necessary and sufficient: (i) a pretender (ii) a reality (iii) a mental representation that is different from reality (iv) a layering of the representation over the reality, such that they exist within the same space and time, and (v) awareness on the part of the pretender of components (ii), (iii) and (iv)." (Lillard, 1993a, p.349)

Note that Lillard's is not an operational definition. Hence, Leslie's (1987) definition of observable pretend play remains the most rigorous and usable to date. However, it is possible that pretence "in one's head" will not show up behaviourally (e.g. a child might be pretending to be flying, without moving a muscle). Conversely, Baron-Cohen

(1987) also warns against the false attribution of pretence when none is present, citing the example of a child looking at a wooden brick and saying the word "car", even though the child had no intention of referring to the brick as a car.

Some studies have used the term "symbolic" to include appropriate object use with small-scale objects (Gould, 1986; Lowe and Costello, 1976; Power and Radcliffe, 1989; Wing, Gould, Yeats and Brierley, 1977). This is appropriately labelled functional play since it may not involve pretence at all. Ungerer and Sigman (1981) define functional play as "the appropriate use of an object or the conventional association of two or more objects, such as a spoon to feed a doll or placing a teacup on a saucer" (p. 320). The cognitive operations required to perform such acts do not involve the complexity of pretend play as detailed above. Further, Huttenlocher and Higgins (1978) warn that seemingly symbolic acts may have been learnt directly (modelled) from adults, and may not involve symbolic representational thought. Baron-Cohen (1987) argued that functional play with miniature realistic objects cannot be taken as evidence of symbolism as the objects may simply be perceived as small, yet real, objects.

4.2 PRETEND PLAY IN AUTISM

4.2.1 A review of the experimental work

Although no convincing evidence has overturned the view put forward by Kanner that children with autism have impoverished play (Kanner, 1943), there has been

disagreement about the exact nature of the impairments, and what processes may underlie them. Studies prior to the 1970s are of limited validity since they incorrectly grouped together autistic and schizophrenic patients (see Wulff, 1985; for a review).

One of the first systematic studies to investigate the symbolic play of children with autism was that of Wing et al. (1977). Of the 12 children with autism, 8 showed no play, 4 exhibited stereotyped play and none showed symbolic play. Whilst Wing et al. (1977) conclude that a "complete absence of symbolic play is closely linked to the presence of typical early childhood autism", Jarrold et al. (1993) criticize the study for a vague and generous definition of symbolic play (which included functional play acts) and for the fact that only 4 children with autism had both a language comprehension age and nonverbal mental age above 20 months, the age at which symbolic play is expected to emerge. Atlas (1990) found that far fewer subjects with autism (3 out of 26 subjects) produced symbolic play, compared to an unmatched comparison group of children with schizophrenia (14 out of 22 showed symbolic play). However, the same criticism of a loose definition of symbolic play can be made against this study. Doherty and Rosenfeld (1984), using free play observation and parental report, compared 7 children with autism to 8 language-disordered children. Whilst none of the children with autism received a definite rating of symbolic play, 7 out of the 8 language-disordered children were rated as showing symbolic play on both observational and parental report measures. Other studies assessing the production of pretend play in unstructured or free-play conditions have produced similar results - children with autism produce significantly less pretend play than chronological or mental age matched comparison groups, although some individual subjects have

produced at least a few examples of symbolic, or pretend, play (DeMyer, Mann, Tilton and Loew, 1967; Stone, Lemanek, Fishel, Fernandez and Altemeier, 1990).

Gould (1986) used the Lowe and Costello Symbolic Play Test (Lowe and Costello, 1976) to compare children with autism and mental handicap controls. Comparing the play produced under these structured conditions to that produced spontaneously, the children with autism achieved lower scores under spontaneous conditions, after the groups had been matched by test score. Power and Radcliffe (1989) found that mental age matched controls scored more highly than children with autism on the Lowe and Costello Symbolic Play Test. However, both of these studies add little to our knowledge of pretend play ability in autism, since the test actually assesses functional and not symbolic play.

Ungerer and Sigman (1981; Sigman and Ungerer, 1984b) modified the systematic study of play in autism by introducing a structured testing condition, whereby the production of play was elicited by specific verbal prompts or models, if play was not produced spontaneously. They also adopted a more rigorous definition of symbolic play, separating symbolic from functional play. The children with autism produced fewer functional and symbolic acts than mental handicap controls under both spontaneous and structured conditions. However, the number of symbolic acts produced by the autism group did rise following verbal prompts and modelling. Baron-Cohen (1987) criticized the eliciting procedures employed, which included direct modelling of symbolic acts, on the grounds that the production of a symbolic act by the child might have reflected imitation rather than real symbolic ability. Mundy et

al. (1986) found similar results when comparing children with autism, mental handicap and normally-developing controls.

Baron-Cohen (1987), using control groups matched for verbal mental age, assessed the production of sensorimotor, ordered, functional and pretend play under spontaneous, or free, play conditions. Whilst all three groups (autism, mental handicap and normal) were near ceiling in production of functional play, only 20% of the children with autism produced pretend play, compared with 80% of the mental handicap controls and 90% of the normally-developing children. Autism-specific deficits in symbolic play were also found under structured testing situations by Wetherby and Prutting (1984) and Riguet, Taylor, Benaroya and Klein (1981). Whilst Jarrold et al. (1993) criticise these studies for poor matching procedures, specifically matching by general mental age rather than verbal mental age (e.g. Sigman and Ungerer, 1984b; Ungerer and Sigman, 1981), and for using a verbal test assessing vocabulary rather than grammatical understanding (Baron-Cohen, 1987), the results show a consistent autism-specific deficit with the production of pretend play under spontaneous and structured conditions.

However, there have been a few studies which have not shown the same pattern of results. Lewis and Boucher (1988) tested the symbolic play of children with autism under three conditions: (i) spontaneous play, (ii) elicited play following a general prompt ("What can you do with these?"), and (iii) instructed play following a specific prompt ("Can you put the car in the garage?"), with a combination of miniature objects and junk materials available. Very little spontaneous play was produced by

either the autism or the control groups in the spontaneous condition, although the children with autism spent less time playing functionally than the learning difficulties and normal control groups. In the elicited and instructed conditions the children with autism produced as many functional and symbolic acts as the controls. Although Baron-Cohen (1990b) has subsequently argued that the scaffolding provided in the elicited and instructed conditions do not require children to generate symbols for themselves, Boucher and Lewis (1990) have published examples of the symbolic acts produced by children with autism, which they defend as imaginative and creative. Charman and Baron-Cohen (1994b) have recently attempted to tackle the effect of structure, or scaffolding, on the play produced by children head-on. When maximal cues were provided, children with autism were able to produce functional and simple pretend (object-substitution) play. However, they generated less *novel* pretend acts compared to mental handicap controls. Recently, Jarrold et al. (1994) have demonstrated some intact comprehension of pretend actions in children with autism, although methodological weaknesses of this study (floor effects for the control groups) means that further work will be needed to clarify if children with autism fully comprehend pretend play. In addition, it is not clear if the Jarrold et al. (1994) procedure necessarily requires a concept of pretending for a child to pass.

4.2.2 Methodological issues

Two methodological points should be noted. First, the production of pretence in children with autism has been assessed under two general setting conditions: (i) unstructured, spontaneous conditions, and (ii) structured, prompted or elicited

conditions. All studies show an impairment in the production of pretend play in children with autism (in comparison to mental-aged matched controls) in unstructured, spontaneous conditions (Baron-Cohen, 1987; Lewis and Boucher, 1988; Riguette et al., 1981; Sigman and Ungerer, 1984b; Ungerer and Sigman, 1981). After general or specific prompts are given, children with autism tend to produce some pretend play, although in most studies the group differences still remain (Riguette et al., 1981; Sigman and Ungerer, 1984b). In others, they disappear (Charman and Baron-Cohen, 1994b; Lewis and Boucher, 1988). Results on the production of functional play are mixed, with some studies showing intact functional play ability (Baron-Cohen, 1987; Charman and Baron-Cohen, 1994b; Lewis and Boucher, 1988), whilst others show impaired functional play too (Gould, 1986; Power and Radcliffe, 1989; Sigman and Ungerer, 1984b; Ungerer and Sigman, 1981).

Secondly, it is important to consider the role of verbal mental age (VMA) in the production of pretend play. Of those studies which report the contribution of mental age to pretend play ability in autism, Baron-Cohen (1987) found that subjects with autism who did pretend had a higher VMA and non-verbal mental age (NVMA) than those who did not. Similarly, Ungerer and Sigman (1981) found a positive correlation between MA and functional, but not pretend, play. Riguette et al. (1981) found a positive correlation between object substitution and VMA, and Charman and Baron-Cohen (1994b) report that the subjects who produced least functional and pretend play had the lowest VMA. In addition, a comparison of the subjects with autism employed in each study also reveals a possible effect of MA. In the studies which demonstrate the most clear and sustained impairment in spontaneous pretend play in autism, the

MA of the subjects was low (Baron Cohen, 1987: mean VMA = 30 months; Riguet et al., 1981: mean VMA = 31 month; Ungerer and Sigman, 1981: mean MA = 33 months). In comparison, in the studies which showed less severe impairment under elicited conditions MA was higher (Charman and Baron-Cohen, 1994b: mean VMA = 46 months; Lewis and Boucher, 1988: mean VMA = 69 months). This picture is consistent with Baron-Cohen's (1989) suggestion that the development of pretend play in autism may be significantly delayed, and only emerges at a much later age than in normally developing children and children with a mental handicap without autism, in whom the development of pretend play is mental-age appropriate (Beeghly, Perry and Cicchetti, 1989; Hill and McCune-Nicolich, 1981).

4.2.3 Theoretical issues

Various attempts have been made to explain the particular nature of the difficulties children with autism have in producing pretend play. These broadly fall into two types: theories which posit a competence deficit, and theories which posit a performance deficit. Perhaps the most developed of the competence theories was proposed by Leslie (1987), who suggested that pretence involves metarepresentation - which under his definition requires the child representing its own attitudes to information (i.e. *knowing* that this banana is a banana *and pretending* that this banana is now a telephone, at the same time). In an alternative competence deficit theory, Hobson (1990c, 1991b) and Rogers and Pennington (1991) have emphasized the role of deficits in the development of patterns of social-affective relations, principally primary intersubjectivity (Stern, 1985; Trevarthen, 1979) and personal relatedness

(Hobson, 1993a,b), which they hold are necessary for the later development of pretend play.

Two types of performance deficit have been put forward to explain the experimental findings. On the one hand, Lewis and Boucher (1988) and Jarrold et al. (1993) suggest that since, in some studies, prompts increase the amount of both functional and pretend play, this supports a motivational deficit theory. On the other hand, Harris (1993) interprets the increase in pretend and functional play, when more external structure, or scaffolding, is provided, as evidence of an executive function impairment. This is plausible, given that pretend play, at least under spontaneous or unstructured conditions, requires the formulation and execution of a complex plan and an ability to shift attention from reality to pretence. Other recent research indicates that children with autism may be impaired in some aspects of executive function (Hughes and Russell, 1993; McEvoy, Rogers and Pennington, 1993; Ozonoff et al., 1991a; see Bishop, 1993, for a review).

Other authors have taken issue with these theories. For example, challenging the necessary role of metarepresentation in pretend play, Perner (1991, 1993) suggests that there is no reason to assume that in *early* pretence (e.g. object substitution) the child is representing a representational mental state - at least not fitting with Pylyshyn's (1978) definition of metarepresentation. The child may simply pretend by acting *as if* the banana is a telephone, but that need not mean s/he is treating it as a *symbol* for a telephone, or representing its own informational attitude. Similarly, Lillard (1993a,b) suggests pretence may only require understanding of correspondence, rather than

representation. Leslie (1994) criticises these alternatives as behaviourist theories of pretence.

Charman and Baron-Cohen (1994b) propose that *early emerging* pretence (i.e. object substitution) may require qualitatively different cognitive capacities from *later emerging* pretend play. One characteristic of later emerging pretence, which is not necessary for simple object substitution under structured conditions, is the ability to *generate* novel play acts. Here, the child is acting less in response to prompts but is involved in a more creative, generative exercise. They suggest that generating novel object substitutive acts is likely to involve a complex mix of both metarepresentation (in Leslie's sense) and executive function abilities. In the light of these theoretical considerations, the demonstrations of pretend play (predominantly object substitution) by children with autism in structured situations (Gould, 1986; Lewis and Boucher, 1988) may only be an indication of the ability to understand the correspondences between an actual object reality and a pretend use, but not evidence of a capacity to *generate* pretence.

4.3 PRETEND PLAY AS A PRECURSOR TO A THEORY OF MIND

4.3.1 Leslie's metarepresentation hypothesis

Leslie's (1987) important theoretical contribution was to propose pretence as an early manifestation of the child's ability to metarepresent. He directly linked the cognitive capacities required in pretending to the later development of a theory of mind. Since

Leslie's account has become the benchmark against which other more recent theories have been assessed I will present the theory he expounded in some detail. Leslie's (1987) basic premise is that:

"The emergence of pretence is not seen as a development in the understanding of objects and events as such, but rather as the beginnings of a capacity to understand cognition itself. It is an early symptom of the human mind's ability to characterize and manipulate its own attitudes to information." (p. 416)

Leslie (1987) adopts an explicit cognitivist, information processing stance, in attempting to characterise pretence. Primary representations are understood to be basic, ecological representations of the world, which are accurate, faithful and literal, as far as is possible for any given organism. Pretence involves the child having two simultaneous representations of the situation; one represents how the situation is actually perceived, whereas the other represents what the pretence is. In addition, the pretend representations relate to the primary representations in a specific way. To use Leslie's (much repeated) example of a child pretending that a banana is a telephone receiver: It is *this* banana that I pretend is a telephone. Leslie argues that these representations cannot both be primary, since primary representations have a literal, or true, meaning, which would lead to representational abuse. To avoid representational abuse, pretend representations must be marked off, or quarantined, from primary representations. They do not have the same reference, truth and existence relations as primary representations.

Drawing on Quine's (1961) notion of propositions involving mental states being referentially opaque, that is, suspending normal reference relations, Leslie (1987) contrasts the transparency of primary representations - they directly represent objects, states of affairs, and situations in the world - with the referential opacity of pretend representations. Pretend representations are not representations of the world but representations of representations. Leslie calls them second-order representations, or metarepresentations (Pylyshyn, 1978). In doing so Leslie (1987) is able to complete his informational processing accounts of the cognitive processes used to pretend:

"The opacity of metarepresentations explains how representational abuse is avoided. The basic feature of my model is the creation of a pretence by the copying of a primary expression into a metarepresentational context. This second-order context in effect gives a report or quotation of the first-order expression. In doing this, it renders opaque the expression that was previously transparent. Its reference, truth, and existence relations are suspended while it appears in this context. Using an appropriate mechanistic metaphor, one can say that the metarepresentational context *decouples* the primary expression from its normal input-output relations. Meanwhile the original primary representation, a copy of which was raised to a second order, continues with its definite and literal reference, truth, and existence relations. It is free to continue exerting whatever influence it would normally have on ongoing processes." (p. 417)

Whilst Leslie details the internal computational mechanics of his model in

considerable detail, the outline given above is sufficient for the present purpose. To continue with the example given above; the primary representation **this is a banana** is decoupled to "**this is a banana**". Its normal semantics are now suspended, and the expression can be transformed without fear of representational abuse. For example, it is possible to transform the expression "**this is a banana**" into "**this banana is a telephone**". Leslie (1987) develops a shorthand notation for such a process:

I PRETEND "*this banana* is a telephone."

Leslie (1987) notes that to employ a theory of mind requires that one can comprehend opaque states in oneself and in others. In Leslie's view this involves a similar process to that required to pretend; namely the ability to metarepresent. However, we know that infants demonstrate early evidence of metarepresentational ability, by pretending by 2 years of age, but do not show theory of mind competence (at least as shown by passing false belief tasks) until about 4 years of age (Wimmer and Perner, 1983). Pretending and false-belief tasks differ markedly in the complexity of the reasoning required. This may be because in pretence the metarepresentational relations are given, whereas in false-belief understanding the answer must be worked out.

Leslie (1987) uses the case of autism to support his proposal of pretence as a precursor of a theory of mind. He notes that primary representational abilities such as object concept and causality develop in line with MA in autism (Baron-Cohen, 1985; Curcio, 1978; Sigman and Ungerer, 1981), but that pretend play and theory of mind competence, which rely on metarepresentation, are impaired relative to MA. Thus, in

autism, there is an apparent dissociation between primary and metarepresentation abilities, with primary representation systems reflecting the general level of mental handicap, whilst there is a specific metarepresentational deficit. In this thesis Leslie's theory will be characterised as the *metarepresentational deficit hypothesis* of autism.

4.3.2 Other views on pretence as a precursor

In line with Leslie's (1987), account Baron-Cohen (1987) characterises the deficits in symbolic, or pretend, play in autism as a deficit in the capacity to form and manipulate second-order representations. He delineates the conceptual distinction between *signs* - which are merely representations of objects - and *symbols* - which are representations of a concept (which is itself refers to an object). He argues that symbols are therefore representations of a representation, in other words a second-order representation. He quotes the distinction made by Langer (1942):

"A sign indicates the existence - past, present or future - of a thing, event or condition" (p. 57)

"Symbols are not proxy for their objects, but are vehicles for the conception of objects...it is the conceptions, not the things, that symbols directly "mean"."
(p. 60-61)

Following on from the earlier work of Sigman and Ungerer (1984b) he names this the *symbolic deficit theory* of autism, and directly links deficits in symbolic play to

deficits in theory of mind.

However, as mentioned earlier, other authors have taken issue with Leslie's thesis that pretend play necessarily involves metarepresentation, and that pretence marks the emergence of a child's ability to comprehend mental states, leading eventually to the development of a theory of mind. Perner (1991, 1993) asserts that *early* pretend actions (e.g. object substitution) may simply be acting *as if*. Similarly, Lillard (1993a,b) suggests pretence may only require understanding of correspondence, rather than representation. Where do these alternative theories leave pretend play as a precursor to the development of a theory of mind? Lillard (1993a) states that the evidence for metarepresentation in pretend play is illusory, or "fools gold", and is not supported by the evidence for a child's understanding of representations in non-pretend situations. As such, pretence may have no role as a precursor. Harris (1993) ascribes both the characteristic deficits in pretend play and theory of mind in autism to an underlying deficit in executive function. Note that this still allows pretence to stand as a precursor to a theory of mind, in Gomez et al.'s (1993) "John the Baptist" mode, but in this case the underlying deficit is in executive function.

4.4 EXPERIMENT TWO

Method

Two sets of play tests were given, at different times during the testing session. For all children the testing session began with a period of *spontaneous or free play*. This was

designed to acclimatize the infant to the room and to the presence of the experimenters. For most subjects a series of *structured play tests* followed on from the period of spontaneous play. However, some children were reluctant to engage in the structured play session, and rather than persist and disrupt the session, the structured play tests were removed and attempted later in the session (details of subject compliance are given below).

4.4.1 Spontaneous/free play

When the child entered the room the following sets of toys were all available, spread out on the floor:

- (a) A toy teaset.
- (b) A toy kitchen stove with miniature pots and pans, spoon, pieces of green sponge. The pieces of sponge are considered the essential element since they could only be used in pretend rather than functional play (see Baron-Cohen, 1987).
- (c) Junk accessories (e.g. brick, straw, rawplug, cottonwool, cube, box) and conventional toy accessories (toy animals, cars etc.).

The child's parent(s) and the experimenters remained seated, and offered only minimal and non-specific responses to child-initiated approaches. Each child was filmed for 5 minutes. The combination of objects made available was based on the earlier studies with children with autism conducted by Baron-Cohen (1987) and Lewis and Boucher (1988).

Scoring

The children's toy-directed behaviour was filmed onto videotape and subsequently coded. Each novel play act produced by the child during the 5 minute session was coded into one of four mutually exclusive categories (based on Baron-Cohen, 1987):

1. Sensorimotor - banging, waving, sucking, throwing, rolling, 'twiddling', or sniffing objects, with no attention paid to their 'function'.

2. Ordering - the child imposes some pattern onto the objects, such as lining them up, piling them up, putting one inside another, arranging them in systematic ways, but still with no regard for their function.

3. Functional play - using the object appropriately, that is, according to their intended function.

4. Pretend play - child uses an object *as if* it is another object, *or* attributes properties to an object which it does not have, *or* refers to absent objects as if they were present e.g. the child drinks from empty cup, pours from empty teapot.

If there was uncertainty over any rating, the action was scored conservatively (i.e. the lower developmental categorization was scored: Sensorimotor < Functional < Pretend). In addition, two measures were taken of the quantity of behaviour occurring in each of the four categories: (i) The number of different (i.e. novel) examples produced in

each category, and (ii) The number of different toys used in each category. A note was also made of the presence of (a) doll-related and (b) non doll-related play across all 4 categories of play.

Inter-rater reliability

17 of the trials were rated by a second rater for the presence or absence of each of the four categories of play. The inter-rater reliabilities for the spontaneous play categorisations, expressed in terms of percentage agreement, and as measured by Cohen's kappa (Cohen, 1960), are shown in Table 4.1. Across all 4 categories, the mean agreement measured in percentage terms was 90% (range 82% to 94%), and as measured by kappa 0.75 (range 0.55 to 0.85).

4.4.2 Structured play

A series of structured play tasks designed to maximize the scaffolding provided by the context (based on Charman and Baron-Cohen, 1994b) were conducted. It was hoped that these would provide a measure of the of the child's functional and object substitution play, which might be missed by the spontaneous play session, where the child was left free to spend the time how they choose, and which might lead to an underestimation of their play abilities. Each child was given the functional and object substitution tasks in the order described below:

1. Object substitution trial 1 - child presented with a toy telephone with a *banana*

in place of a *receiver*.

2. Functional trial 1 - child presented with a *doll* and a *toy spoon*
3. Object substitution trial 2 - child presented with a *doll* and a *metal rod*
4. Functional trial 2 - child presented with a *doll* and a *toy cup*
5. Object substitution trial 3 - child presented with a *doll* and a *wooden brick*

In turn, each set of objects was placed onto a table, or onto the floor, (whichever the child appeared to prefer) in front of the child. The following series of scaffolding prompts was given until a response was made:

1. First, an *open prompt* was given ("What can you do with these?") and for 20 seconds the subject was given an opportunity to respond.
2. Next, a *specific prompt* was given (e.g. "Let's pretend. Give the dolly a drink of juice.") and for 20 seconds the subject was given an opportunity to respond.
3. Finally the functional or pretend play action was *modelled* and a specific prompt was given (e.g. "Let's pretend. Give the dolly a drink of juice.") and for 20 seconds the subject was given an opportunity to respond.

Scoring

On each trial the first response made (under the open prompt, specific prompt or modelled conditions) was scored according to the following criteria:

1. On the functional trials, functional play was scored if the spoon/cup was placed onto the doll's mouth in a feeding/drinking motion.
2. On the object substitution trials, pretend play was scored if the rod/brick was placed onto the doll's mouth in a feeding/drinking motion; or the banana was picked up and held to the child's ear and mouth.

Inter-rater reliability

30 of the structured play trials were videotaped, and a second experimenter rated responses across the four categories: open prompt, specific prompt, modelled, and no response. Measured in percentage terms the agreement was 90%, and as measured by Cohen's kappa (Cohen, 1960) the mean agreement was 0.85 (see Table 4.1).

Table 4.1 Inter-rater reliability for play measures

	Percentage agreement	Kappa
Unstructured play		
Sensorimotor	*	*
Ordering	94	0.85
Functional	82	0.55
Pretend	94	0.85
Structured play	90	0.85

* insufficient variance to calculate kappa

4.5 RESULTS

4.5.1 Spontaneous/free play

The percentage of children in each group producing at least one example of play in each of the four categories - sensorimotor, ordering, functional and pretend - is shown in Table 4.2. One child from the developmental delay group and one child from the normal group did not participate in this task due to non-cooperation. Employing a non-parametric analysis, there were no group differences for the production of sensorimotor ($X^2 = 3.57$, $p = ns$), ordering ($X^2 = 3.11$, $p = ns$) or functional play ($X^2 = 1.58$, $p = ns$). However, only one child in the autism group produced any examples of pretend play, significantly less than in the developmental delay and normal groups ($X^2 = 9.09$, $p < 0.02$; post-hoc Fisher's exact: A x DD $p < 0.05$; A x N $p < 0.004$; DD x N = ns).

In addition, post-hoc comparisons comparing the mean CA, NVMA, and LA of the children who produced each category of play in each group, with that of children who did not, were conducted. Due to the multiple comparisons this involved, a conservative level of significance of $p < 0.01$ was adopted, in order to minimise the risk of false positives, or Type I errors. In both the autism and normal groups there were significant differences in the LA scores of those children who produced pretend play, compared to those who did not. The one child with autism who produced pretend play had a LA z-score of 0.25, compared to a mean LA z-score of -1.87 (standard deviation 0.44) for the 12 children who produced no examples of pretend play (ANOVA, F

(1,11) = 21.9, $p < 0.001$). Similarly in the normal group, the 10 children who produced pretend play had a higher LA z-score than the 7 who did not (mean = 0.61, s.d = 0.87 vs. mean = -0.58, s.d. = 0.26 respectively; ANOVA, $F(1,15) = 10.3$, $p < 0.007$). There were no significant differences in CA, NVMA or LA between those children who produced, and those who failed to produce, any of the other categories of play, across all of the diagnostic groups.

There were no significant group differences on the other measures taken during the free play session. Across all three groups the presence of doll-related play was low and there were no group differences ($X^2 = 3.23$, $p = ns$). Children with autism demonstrated less different examples of play acts, across all four categories, and used less toys in total, than the two other groups. However, group differences failed to reach significance when analyzed by ANCOVA with CA, NVMA and LA entered as covariates (ANCOVA, $F(2,40) = 1.45$, $p = ns$; and ANCOVA, $F(2,40) = 0.74$, $p = ns$; respectively), although there was a significant covariate effect for CA for number of different examples of play acts produced, with older children producing more play acts than younger children (ANCOVA, $F(1,40) = 2.20$, $p < 0.04$). These results are summarised in Table 4.3.

4.5.2 Structured play tasks

Across both the functional and the object substitution trials non-completion rates were relatively high. It is likely that the experimenter-directed nature of these tasks accounts for the relatively low completion rates. If a child made no attempt to pick up the

objects placed in front of them, or looked away on presentation of the objects, the trial was deemed to be invalid and the data counted as missing. Many of the children across all of the diagnostic groups were uncooperative in this way, on at least some of these trials, leading to considerable missing data. Data completion was highest for the earlier-conducted trials (phone, spoon and rod) and lowest for the later-conducted trials (cup and brick). For the autism, developmental delay, and normal groups, respectively, the numbers of children completing each trial were as follows: phone (11, 13, 14), spoon (7, 11, 13), rod (4, 7, 13), cup (2, 8, 11), and brick (2, 5, 9). Therefore, in order to provide meaningful comparisons between the groups on the structured play tasks, the production of any one example of the target functional or object substitution act was scored across the two functional and three object substitution trials. The numbers of children in each group who produced at least one functional or object substitution act are shown in Table 4.4. In addition, an overall pretend play measure incorporating the production of pretence during *either* the free play trial *and/or* the production of object substitution during any of the structured object substitution trials was calculated, and is also shown in Table 4.4.

There were significant group differences on the functional trials. Only 2 of the children with autism (out of 7 who completed at least one functional trial) produced the required functional act, even after the prompts and model had been given. This was significantly less than the children in the normal group - all 11 of whom produced at least one functional act - and less than the children with developmental delay, although the post-hoc comparison revealed that this latter trend did not quite reach significance ($X^2 = 12.1$, $p < 0.003$; Fisher's exact: A x DD $p < 0.08$; A x N $p <$

0.003; DD x N = ns). In the object substitution trials only one child with autism produced an example of object substitution, even after prompting and modelling. This was significantly less than the developmental delay and normal children, of whom three-quarters produced at least one object substitution ($X^2 = 14.6$, $p < 0.001$; Fisher's exact: A x DD $p < 0.001$; A x N $p < 0.002$; DD x N = ns). Similarly, on the combined spontaneous and structured pretend measure only two children with autism produced examples of pretend play (one in the spontaneous task and one in the structured task), significantly less than the children in the other two groups ($X^2 = 15.5$, $p < 0.001$; Fisher's exact: A x DD $p < 0.003$; A x N $p < 0.001$; DD x N = ns). Using similar post-hoc comparisons to those described above (Section 4.5.1), of the mean CA, NVMA, and LA of those children in each group who produced, or failed to produce, examples of functional or object substitution play, only one difference was found. The two children with autism who produced pretend play in either the spontaneous play trial (one child), or the structured object substitution trials (one child), had a higher LA than those who did not (mean = -0.40 s.d. = 0.92 vs. mean = -1.95, s.d. = 0.37 respectively; ANOVA, $F(1,11) = 20.2$, $p < 0.001$). These results are summarized in Table 4.5.

Table 4.2 Production of categories of play by diagnostic group

	n	S-M	Ordering	Functional	Pretend
Autism	13	100.0%	7.7%	69.2%	7.7%
Developmental delay	17	88.2%	5.9%	82.4%	41.2%
Normal	16	100.0%	25.0%	87.5%	62.5%*
# X² = 9.09 p < 0.02 [Fisher's exact: A x DD p < 0.05; A x N p < 0.004]					

Table 4.3 Production of doll-related play, number of different play acts, and number of toys used by diagnostic group.

	Doll-related play	Number of play acts x (sd)	Number of toys used x (sd)
Autism	15.4%	2.85 (1.34)	5.46 (2.44)
Developmental delay	41.2%	3.76 (1.79)	6.23 (2.51)
Normal	18.8%	4.75 (1.84)	7.06 (2.54)

Table 4.4 Production of functional play, object substitution and the overall spontaneous + structured pretend play measure by diagnostic group.

	Functional trials	(n)	Object substitution trials	(n)	Overall pretend measure	(n)
Autism	28.6%	7	9.1%	11	15.4%	13
Develop. delay	72.7%	11	78.6%	14	72.2%	18
Normal	100.0% [#]	13	73.3% [*]	15	82.4% ⁺	17
<hr/>						
# X² = 12.1	p < 0.003	[Fisher's exact: A x DD = ns; A x N p < 0.003; DD x N = ns]				
* X² = 14.6	p < 0.001	[Fisher's exact: A x DD p < 0.001; A x N p < 0.002; DD x N = ns]				
# X² = 15.5	p < 0.001	[Fisher's exact: A x DD p < 0.003; A x N p < 0.001; DD x N = ns]				

Table 4.5 Comparison of CA, NVMA and LA of children producing functional and object substitution play on structured play tasks, and overall pretend measure.

Diagnostic group	n	CA x (sd)	NVMA x (sd)	LA x (sd)
Autism				
Functional present	2	20.1 (0.3)	15.7 (1.9)	-1.63 (0.18)
Functional absent	5	21.1 (1.9)	16.8 (1.3)	-2.13 (0.29)
Object substitution present	1	20.4 (-)	18.0 (-)	-1.05 (-)
Object substitution absent	10	21.0 (1.4)	17.1 (1.7)	-1.97 (0.37)
Overall pretence present	2	19.8 (0.9)	18.3 (0.5)	-0.40 (0.92)
Overall pretence absent	11	20.9 (1.4)	16.9 (1.8)	-1.95 (0.92)*
Developmental delay				
Functional present	8	20.4 (1.6)	19.0 (1.6)	-1.41 (0.37)
Functional absent	3	20.2 (1.1)	16.0 (2.8)	-1.52 (1.23)
Object substitution present	11	20.5 (1.4)	17.6 (2.3)	-1.60 (0.46)
Object substitution absent	3	21.9 (3.0)	18.2 (2.1)	-1.23 (0.95)
Overall pretence present	13	20.5 (1.3)	17.8 (2.2)	-1.56 (0.44)
Overall pretence absent	5	21.9 (2.4)	17.8 (1.4)	-1.50 (0.87)
Normal				
Functional present	13	20.3 (1.1)	20.8 (1.6)	0.20 (0.95)
Functional absent	-	-	-	-
Object substitution present	11	20.4 (1.1)	21.4 (0.8)	0.34 (0.95)
Object substitution absent	4	20.2 (0.8)	19.6 (2.4)	-0.59 (0.34)
Overall pretence present	14	20.4 (1.0)	20.9 (1.5)	0.24 (0.95)
Overall pretence absent	3	20.3 (0.9)	20.2 (2.5)	-0.47 (0.29)

ANOVA F (1,11) = 20.2

p < 0.001

4.6 DISCUSSION

4.6.1 Comparison with previous findings

There was only one clear difference between the groups on the spontaneous play task: fewer children with autism produced pretend play than developmentally delayed or normal children. The specific impairment found in the production of spontaneous pretend play replicates the findings of previous studies with older and more able children with autism, who have consistently been shown to be impaired in the production of pretend play under similar conditions (Baron-Cohen, 1987; Lewis and Boucher, 1988; Sigman and Ungerer, 1984b; Ungerer and Sigman, 1981). However, contrary to the present results, Lewis and Boucher (1988) found that under spontaneous, or unprompted, conditions both the mental handicap and normal control children also failed to produce pretend play. The finding that children with autism were intact on their production of spontaneous functional play acts replicates the findings of Baron-Cohen (1987), Lewis and Boucher (1988), and Ungerer and Sigman (1981), but contrasts with the finding of Sigman and Ungerer (1984b) that children with autism produced less functional play than controls.

The finding that in the autism and normal groups the children who produced spontaneous pretend play had a higher LA than those who did not mirrors that reported by Baron-Cohen (1987), who found that the 2 children with autism who produced pretend acts had higher NVMA and VMA than the other children, although for normal children Baron-Cohen reports a difference in the same direction for NVMA

only. No differences on CA, NVMA or LA were found for functional play, contrary to the finding of Sigman and Ungerer (1984b; Ungerer and Sigman, 1981) that children with autism who produced functional play had a higher LA. There was a non-significant trend for children with autism to use less toys, and to produce less different play acts, across all four play categories, similar to that found by Sigman and Ungerer (1984), although this contrasts with Lewis and Boucher's (1988) finding that children with autism used more toys than controls.

In the structured play tasks, children with autism produced less functional play acts than the control groups, and less object substitutions (intended, using Leslie's (1987) definition of pretence, to be examples of simple pretend acts). This replicates the findings of Sigman and Ungerer (1984), but contradicts those of Charman and Baron-Cohen (1994b) using the same materials with older children, and of Lewis and Boucher (1988) who found no group differences in the production of functional and symbolic play acts under prompted, or elicited, conditions.

Although the spontaneous and structured play tasks cannot be directly compared, since they employ different play materials, there was no facilitation in the production of pretend play acts by the children with autism under elicited conditions, compared to under spontaneous conditions, similar to that reported by Sigman and Ungerer (1984) and Lewis and Boucher (1988). Indeed, although children with autism were intact on the production of functional play in the spontaneous play task, they were specifically impaired compared to the control groups on the two structured play functional trials. This may in part reflect the experimenter-directed nature of the trials, with the

experimenter placing the target objects (e.g. a doll and a spoon) in pairs before the child. The children with autism were the most difficult subjects to engage in these trials, and although there was some non-completion in the developmental delay and normal groups, only 7 children with autism completed at least one of the two functional trials.

4.6.2 Relation to theoretical accounts of pretend play development in autism

Given that previous findings with older and more able children with autism have consistently found that under spontaneous, or free play, conditions children with autism do not produce pretend play, the present finding that this sample of 20-month-old children with autism were impaired in the production of pretend play was expected. At first sight, the results fit with Leslie's (1987) metarepresentation hypothesis of pretend play (see Section 4.3.1), as well as the competing accounts which explain the autistic deficit in pretend play in terms of an executive functioning deficit (Harris, 1993), or a motivational, or conative, deficit (Jarrold et al., 1993; Lewis and Boucher, 1988). However, by studying the profile of performance of the three experimental groups across both the spontaneous and the structured play tasks, the relationship between play performance and NVMA and LA, and by comparing the present findings with previous research, we find clues to the natural history of normal and abnormal pretend play in infancy.

A key piece of supporting evidence for both the executive function and motivational accounts of the pretend play deficit in autism is that under prompted or scaffolded

conditions children with autism are able to produce pretend play acts, which they do not under spontaneous conditions. In the present study, employing children with autism with a CA of 20 months, an autism-specific impairment in the production of pretend play was found for the children with autism on *both* the spontaneous *and* the structured, or prompted, tasks.

In addition, the present study found relationships between LA and the production of pretend play in the children with autism and the normal children, similar to that previously reported (Baron-Cohen, 1987; Charman and Baron-Cohen, 1994b). By examining the relationships between play abilities and CA and MA, both *within* and *across* studies, a developmental account of pretend play and its impairment in autism begins to emerge. Such a stance led Baron-Cohen (1989a) to suggest that the development of pretend play in autism may be significantly delayed, and only emerges at a much later age than in normally-developing children, and children with a mental handicap but without autism, in whom the development of pretend play is mental-age appropriate (Beeghly, Perry and Cicchetti, 1989; Hill and McCune-Nicolich, 1981). It is possible to track the development of pretend play abilities in autism, across the present and previous research. Sigman and Ungerer's (1984) sample, who were found to be impaired on their measures of both functional and pretend play (even when prompted), were young and had a low MA (mean CA = 52 months; mean Cattell MA = 25 months; mean Merrill-Palmer MA = 33 months) - both MA measures confound VMA and NVMA and given the characteristic dissociation between the two in autism (DeMyer, 1976) represent an overestimation of verbal ability. The present sample of children with autism - the youngest studied to date - were only able to produce

functional play, although they did not do so reliably in the structured tasks. Older samples, such as those studied by Baron-Cohen (1987: mean CA = 97 months; mean VMA = 30 months, mean NVMA = 59 months) and Riguet et al. (1984: mean VMA = 31 months) were able to produce functional play but not pretend play. The oldest samples so far studied were able to produce pretend play acts when prompted, but did not produce spontaneous or novel pretence (Charman and Baron-Cohen, 1994b: mean CA = 46 months, mean NVMA = 90 months, mean VMA = 46 months; Lewis and Boucher, 1988: mean CA = 142 months; mean BPVS VMA = 57 months). In addition, in the present study, approximately three-quarters of the 20-month-old children with developmental delay and the normal children produced situationally appropriate object substitution in the structured play task, and approximately half produced spontaneous pretend play.

Certainly, the present results and those of Charman and Baron-Cohen (1994b) rule out a strong version of the motivational deficit hypothesis (Jarrold et al., 1993; Lewis and Boucher, 1988), at least for infants. The present study also weakens the executive function account of pretend play deficits in autism, since these young children with autism did not produce pretend play even when considerable scaffolding or prompting was provided (Harris, 1993; Jarrold et al., 1993). To argue that in older children with autism there is an executive planning deficit, whilst in younger children with autism there is an additional deficit (in the same or another cognitive system), would be an unparsimonious explanation for the present findings. In addition, the fact that spontaneous functional play was *not* shown to be impaired in the present sample, and that situationally-appropriate object substitution can be produced by older children

with autism, suggests that these behaviours may rely on qualitatively different cognitive abilities from later-emerging spontaneous and novel pretence.

4.6.3 Implications for the status of pretend play as a precursor to a theory of mind

What do the present results say about the status of pretend play as a precursor to the development of a theory of mind? Within the present research design, the present findings do not rule out (and provide some support for the notion) that pretend play acts as a developmental precursor to a theory of mind. In the next chapter, a test of the third putative precursor, joint attention, is reported.

CHAPTER FIVE:

JOINT ATTENTION

5.1 JOINT ATTENTION IN INFANCY

Joint attention behaviours develop pre-linguistically and involve the triadic coordination of attention between the infant, another person, and an object, or event (Bakeman and Adamson, 1984). Joint attention behaviours include both the coordination of gaze between 2 individuals in the *absence* of gestures, and the coordination of gaze between 2 individuals *accompanied* by gestures, such as pointing, reaching and showing. The development of joint visual attention in the absence of gestures precedes that of proto-deictic gestures, such as pointing and showing. In turn, joint attention behaviours are thought to be an important basis for the acquisition of speech (Bates, 1979; Bruner, 1983). The normal developmental course of each of these sets of joint attention behaviours is reviewed next.

2.1.1 Gaze monitoring

Butterworth (1991) defined deictic gaze, as "looking where someone else is looking". In this thesis the term "gaze monitoring" will be used, since this seems more descriptive. Although the majority of episodes of joint attention, particularly during the first year, arise as a result of the mother or caregiver monitoring the infant's line

of gaze (Schaffer, 1984), it has been demonstrated that infants as young as two months old can readjust their gaze contingent on a change in the focus of attention of an adult (Scaife and Bruner, 1975). In a series of laboratory experiments Butterworth and his colleagues have detailed the development of the mechanisms of joint visual attention in the first two years of life (see Butterworth, 1991; for a review).

The earliest mechanism of joint visual attention Butterworth (1991) describes is called "ecological", and relies on the differentiated structure of the natural environment. At six months of age infants are able to follow the gaze of their mother only within their own visual field, but not, for instance, behind themselves, or when there is another (stationary) target placed along the scan path (Butterworth and Cochran, 1980; Butterworth and Jarrett, 1991). By the age of twelve months the infant is able to localize targets of their caregiver's gaze, whether the target is first or second along the scan path. The sole information base used during this period is the angular displacement of the mother's head and eye movements. However, during the operation of this "geometric" mechanism, as Butterworth calls it, infants are still restricted to targets within their own visual field. By the age of 18 months infants are able to access the invisible portion of space outside their visual field, if there is no competing target within their visual field. Butterworth calls this final mechanism "representational", since it is based on an understanding of being contained within space, which includes the infant and other objects outside the immediate visual field.

5.1.2 Joint attention accompanied by gestures

Joint attention behaviours that accompany gestures include both the *production* of gestures, which function to transmit information to the other person, and the *comprehension* of such gestures in others, accompanied by joint visual attention. Bates (1976, 1979) argued that an intentionally communicative gesture involves making eye contact with the receiver, and that such communicative gestures can be differentiated from other acts in that their intention is directed towards a person rather than towards an object or event. Bates and her colleagues (Bates, 1979; Bates et al., 1979) studied the production of pointing, reaching, showing, and giving, in a sample of infants between 9 and 18 months of age. In this longitudinal study, the use of gestures at 12 months of age, particularly pointing, were found to be good predictors of language development at 18 months of age (Bates et al., 1979).

Masur (1983) found that the coordination of pointing, offering and reaching, with eye contact directed towards mother, or an observer, did not occur until 12 months. Leung and Rheingold (1981) compared the onset of reaching with that of pointing. Reaching developed earlier than pointing and decreased as pointing increased. Furthermore, whilst the ability to follow another's point was acquired before the production of pointing, by 12.5 months a majority of infants pointed, usually accompanied by vocalisations or looks at the partner whilst pointing. Butterworth and Adamson-Macedo (1987), using a technique which is employed in Experiment 3 (see Section 5.4.1), demonstrated that the onset of manual pointing at 13.5 months involved the coordination of viewpoints, with the point holding the position of the object of interest

at the same time as the infant checks that the mother's attention is directed towards the object. Similarly, Schaffer (1984) concluded that following a partner's point first occurs towards the end of the first year at the time the geometric mechanism becomes available, slightly in advance of the production of the gesture. Grover (1988) has shown that adding manual pointing to the gaze-following paradigm which she and Butterworth had utilized with 12-months-olds (Butterworth and Grover, 1988) increased the infant's attention and likelihood of responding, but did not make the space outside the visual field more accessible to the infant.

Franco and Butterworth (1988; 1991) have detailed the development of the communicative function of pointing, and its increasing coordination with gaze monitoring, during the second year of life. At 12 months, infants typically look at a partner after pointing; at 14 months they look whilst pointing; and at 16 months infants look at the partner before initiating the point - as if they are checking that their partner will attend to the point, and their message will be received. They use this developmental sequence to argue that pointing is a specialized form of pre-linguistic reference whose main function is to share attention and interest with a partner.

5.2 JOINT ATTENTION IN AUTISM

Ricks and Wing (1975), and Curcio (1978), first observed that children with autism tended to display fewer joint attention gestures than requesting gestures. Bates, Camaioni and Volterra (1975) characterized the former set of joint attention gestures as *protodeclarative*, gestures which comment or remark on the world to another

person, and the latter requesting gestures as *protoimperative*, that is, gestures which are used in order to use another person to obtain an object.

Subsequent to these initial findings, a series of experimental studies have produced consistent findings that children with autism show specific impairments on measures of both the production and comprehension of protodeclarative joint attention gestures, as well as joint visual attention in the absence of any gesture, whilst their production of protoimperative (requesting) gestures and other non-verbal social-communication skills is intact relative to their overall level of verbal maturation (see Mundy et al., 1993; for a review). These studies are reviewed next.

5.2.1 Protodeclarative and protoimperative pointing in autism

Wetherby and Prutting (1984) found that their sample of four children with autism were able to use gestures to request objects and engage in social action routines, but did not use gestural acts to indicate or share awareness of objects or their properties. Using the Early Social Communication Scales, which involve a series of experimenter-child interactions with a combination of salient toys available, Mundy and Sigman and their colleagues (Mundy et al., 1986; Sigman et al., 1986) found that whilst in several domains - frequency of eye contact, engagement in rough-and-tumble play, and requesting gestures - children with autism produced comparable amounts of behaviour to the mental handicap controls, they were specifically impaired in turn-taking sequences, response to invitations from the adult, and pointing, showing or making eye contact while holding an object or watching an object in motion.

Confirming Hobson's finding (1984), Baron-Cohen (1989c) demonstrated that children with autism have intact perceptual perspective-taking, and are unimpaired in their production and comprehension of protoimperative pointing, whilst exhibiting a specific deficit in both the comprehension (following a point for interest) and production (pointing to or sharing interest in an object) of protodeclarative pointing. Other studies employing differing methodologies have found the same pattern of impaired and intact social gestures (Attwood et al., 1988; Loveland and Landry, 1986). Within the autistic population joint attention skills are both a concurrent and a predictive correlate of language development (Loveland and Landry, 1986; Mundy, Sigman, Ungerer and Sherman, 1987; Stone and Caro-Martinez, 1990). In a longitudinal study which measured the production of gestural joint attention behaviours in children with autism over a 13 month period, Mundy, Sigman and Kasari (1990) demonstrated not only a persistent impairment in protodeclarative skills in children with autism, but found that non-verbal gestural joint attention was a better predictor of language development than either initial language level or IQ. This relationship is similar to that found in normal development (Bates, 1979; Bruner, 1983).

Mundy and his colleagues (Mundy et al., 1986; Mundy et al., 1993) consider what elements are shared, and what elements differ, between protoimperative acts, which are intact in autism, and protodeclarative acts, which are specifically impaired. They discount the role of attention, since requesting actions also require the flexible, triadic attention-deployment necessary for declarative actions. They highlight the role of affect in declarative acts, in that such acts involve sharing an event or experience with another, which may involve conveyance of affect to a greater extent than is involved

in requesting gestures (Bruner, 1981; Mundy et al., 1993). Expression and comprehension of affect are known to be specifically impaired in autism (see Chapter 3; and see Hobson, 1993a,b; for a review). Kasari et al. (1990) measured the expression of affect accompanying joint attention behaviours in children with autism, as well as in mental handicap and normal controls,. They demonstrated that whilst children with autism typically accompanied joint attention behaviours by neutral affect, the controls typically displayed positive affect in conjunction with joint attention behaviours. Similarly, Dawson et al. (1990) found that children with autism did not differ from controls in the frequency or duration of eye contact with mother during face-to-face interaction, but were less likely to combine eye contact with smiles in a single communicative act.

Sigman and Mundy (Mundy and Sigman, 1989; Mundy et al., 1990; Mundy et al., 1993) have also tested the hypothesis (discussed more fully in Section 5.3 below) that joint attention may, to a greater degree than requesting skills, be an early manifestation of symbolic ability, which underlies the later development of pretend play, and the development of a theory of mind. In their longitudinal study of language and other early social-communication accomplishments they found that joint attention deficits were apparent before the emergence of either functional or symbolic play deficits (Mundy et al., 1990). Further, initial joint attention scores, but not requesting-skill scores, were predictive of later symbolic play development in both autistic and language-delayed children.

5.2.2 Eye detection and reading the eyes in autism

Baron-Cohen and his colleagues have recently completed a series of studies which further elucidate our understanding of the specific impairments in visual joint attention, and the role of gaze in this process, in autism. Baron-Cohen (1993) suggests that the comprehension of eye-direction provides crucial information about the *goal* of another person's attention. He lists a set of premises regarding the role of eye-direction in goal-detection:

- "1. That people's attention is normally *directed towards a target*.
 2. That one way in which children compute a person's state of attention is from the *direction of the person's gaze*.
 3. That people's actions are normally *goal-directed*.
 4. That people normally *look* at (attend to) the object they act on."
- (Baron-Cohen, 1993; pp. 74).

Phillips, Baron-Cohen and Rutter (1992), using a methodology employed in Experiment 3 (see Section 5.4.2), found that whilst normal toddlers and subjects with a mental handicap tended look at the adult's eyes following what they term an "ambiguous action", such as offering a toy and then removing it from the child's grasp, children with autism did not seek information about the meaning of the action by making eye contact with the adult.

Baron-Cohen and Cross (1992), and Baron-Cohen, Campbell, Karmiloff-Smith, Grant

and Walker (in press), have shown that whereas normal 3-and-4-year-olds, and children with a mental handicap, were able to judge from eye-direction whether a person was "thinking", and to use eye direction (of both real faces and cartoon faces) to identify which of an array of objects a person is attending to, or desiring, children with autism were poor at inferring these mental states from the eyes. However, some aspects of face, gaze, and direction-processing, were shown to be intact in autism. Children with autism were able to identify "silly" cartoon faces - whose eye orientations were in impossible positions. They were also able to identify "happy" and "sad" faces, when these judgements relied on information in the mouth region of the face, and to follow the line of an arrow to identify which target in an array an arrow was pointing towards (Baron Cohen et al., in press).

Leekam et al. (1993) report that children with autism were able to engage in *visual perspective-taking*, in which a child computes and reports what another person is looking at. However, they found that the same children with autism were specifically impaired in *gaze-monitoring*, which measures the spontaneous tendency to follow gaze in response to another person's change of head and eye movement, compared to controls. They suggest that this dissociation between (impaired) spontaneous monitoring and (intact) geometric analysis of gaze-direction is further evidence of children with autism's inability to recognize or respond to the mentalistic significance of gaze.

5.3 JOINT ATTENTION AS A PRECURSOR TO A THEORY OF MIND

From the above research two closely related strands of argument have developed, both of which characterize joint attention behaviours as developmental precursors to the development of a theory of mind. I will discuss both, in turn, focusing on their main proponents, Baron-Cohen, and Mundy and Sigman, respectively, and then consider related arguments by other researchers.

5.3.1 Baron-Cohen's account

Baron-Cohen (1989c) accounted for the dissociation in autism between (intact) protoimperative and (impaired) protodeclarative skills by ascribing the former to intact primary representational ability, which has been shown to be intact in autism (Baron-Cohen et al., 1986; Curcio, 1978; Sigman et al., 1987), and the latter to more complex, and possibly mentalistic, skills. He summarizes the previous suggestions from the normal developmental literature regarding the status of protodeclarative pointing, as an early form of, or a prerequisite for the acquisition of dialogue (Bruner, 1975); reference (Bruner, 1983); deixis (Clark, 1978); production of speech acts (Dore, 1975); imputing mental states to others (Bates, 1976; Churcher and Scaife, 1981); and symbol use (Bates et al., 1979). Baron-Cohen (1989c) further notes that (with the exception of reference) all of these later-developing skills have been reported to be impaired in autism. He suggests that protodeclarative pointing *may* indeed be essentially similar to a theory of mind, in that it may involve the child representing the state of *thinking*:

"For example, in the production of protodeclarative pointing, the child may need to represent "I want you to attend to what I am thinking about"; and in comprehension, the child may need to represent "You want me to attend to what you are thinking about." (Baron-Cohen, 1989c; pp. 124.)

However, Baron-Cohen points out that protodeclarative pointing *may* be an earlier and simpler ability than a theory of mind:

"It may be that all the child needs to represent is "I want you to attend to what I am attending to" - with no reference to a mental state such as thinking. Representing the goal of shared and differing *attention* between people may be an important but simpler step along the road to representing shared and differing thoughts and beliefs". (Baron-Cohen, 1989c; pp.125.)

In his 1991 chapter, Baron-Cohen (1991c) suggests that joint attention deficits do not affect understanding of simple desires (or the emotions these cause) (Baron-Cohen, 1991b; Harris, Coles and Tan, 1989), but do affect the understanding of even simple beliefs. He goes on to state that understanding attention may be a critical precursor to understanding all mental states that require metarepresentation. Baron-Cohen (1991c, 1993) further elucidates his hypothesis by suggesting that the concepts of attention and goal may function for the 9-to-12-month-old as a simple theory of mind, in that from such concepts the behaviour of others can (sometimes) be predicted. He elaborates on Wellman's (1990) notion of a *desire psychology* which precedes a fully-fledged *belief-desire psychology* (Dennett, 1978a , by proposing an *attention-goal*

psychology as the first stage of such a developmental sequence.

Recently, Baron-Cohen (1994) has extended and summarized his model, detailing the architecture of the possible role of joint attention as a developmental precursor to a theory of mind. He focuses on joint attention, in the form of the Shared Attention Mechanism (SAM), as the fulcrum. Whilst joint attention develops via inputs from primitive perceptual mechanisms, such as an Intentionality Detector (ID) (Premack, 1990) and an Eye Direction Detector (EDD), it is the *triadic representations* that SAM processes which directly facilitate the development of Leslie's Theory of Mind Mechanism (ToMM) (Leslie and Thaiss, 1992).

5.3.2 Mundy and Sigman's account

Mundy and Sigman's (Mundy et al., 1993) model differs from Baron-Cohen's (1993) in the emphasis placed on the integration of affect into the role of joint attention as a precursor, and in its emphasis on the expression of affective states, as opposed to Baron-Cohen's concentration on the comprehension of gaze, attention, goal and intention.

Mundy and Sigman (1989) outline how *both* cognitive and affective factors are involved in the joint attention deficits in autism. They suggest that gestural joint attention skills involve expectations regarding the affect of the other person in object-focused triadic interactions. They contrast the understanding of *overt* behaviour in others, such as behavioural contingencies between infants and caregivers engaged in

reciprocal turn-taking smiling episodes, with the development of metarepresentational skills, which involve the capacity to represent *covert* aspects of the behaviour of others. The disturbance of the understanding of such contingencies, and the subsequent deviant and delayed development of the comprehension and production of affect in children with autism, impairs the child's developing expectations about other people's affect, and its relationship to their own affective experience. Mundy and Sigman (1989) do not claim primacy for either the role of affective or cognitive components in these processes, but suggest that their combined impact underlies the joint attention deficits demonstrated in autism, and their later impairments in the development of a theory of mind.

In the most recent summary of their position, Mundy et al. (1993) utilize data from their recent investigations of the pattern of development of joint attention behaviour, affect expression and play development (reviewed above) to argue that the early stages of autism are characterized by at least two paths of developmental disorder:

"One is a basic disturbance in arousal self-regulation that is associated with atypical affective responses to stimulation (Dawson and Lewy, 1989). The other is a disruption to the cognitive development of representational skills...Within this model, deficits in joint attention are the result of a disturbance of a fundamental process which may contribute to subsequent disturbance in symbolic skill development." (Mundy et al., 1993; pp. 194)

In contrast to Baron-Cohen's account, Mundy et al. (1993) do not detail the link

between such infant-level skills and the later development of a theory of mind, although they acknowledge that the fundamental impairment they are attempting to describe underlies such later impairments. However, they attempt to delineate the primary aetiology of the fundamental impairment as follows:

"We would suggest that in joint attention and affective sharing contexts, such as referential looking, the child is afforded an opportunity to *compare* proprioceptive affective information elicited by an external referent with the perceived affective information emanating from others, relative to the same referent." (Mundy et al., 1993; pp. 195)

"According to this model, then, joint-attention skills need not be considered to be an early manifestation of symbolic or metarepresentational process, at least not in the early stages of joint-attention skill-development. Rather, joint-attention skills presumably reflect part of a developmental process of integrating "self-affect" with "other-affect" that initially involves first order representational skill applied to the realm of affective experience, and ultimately contributes to the development of symbolic representations in the service of interpreting the affect of others." (Mundy et al., 1993; pp. 197)

This notion of comparing proprioceptive information with externally-observed information is similar to that proposed by Meltzoff and others (Gopnik, Slaughter and Meltzoff, 1994; Meltzoff, 1990; Meltzoff and Gopnik, 1993; Rogers and Pennington, 1991) for the role of imitation in the development of a theory of mind (see Section

6.3.2), and also to Hobson's notion of the role of primary intersubjectivity and understanding of affect in the development of a theory of mind (Hobson, 1993a,b; see Section 3.3.1).

5.3.3 Other views on joint attention as a precursor

Leslie and Happe (1989) argue that joint attention deficits are consistent with the metarepresentation account of the theory of mind deficit in autism (Leslie, 1987; Leslie and Frith, 1990). Like Premack (1990) and Baron-Cohen (1994), they suggest that the infant's perceptual systems are hardwired for the direct perception of intention or goal-directedness. Further, although ostensive communication displays (joint attention acts) can be directly perceived, their content or message can only be inferred by a central mechanism that can metarepresent. It is Leslie's view that the Theory of Mind Module (ToMM; Leslie and Thaiss, 1991; Leslie and Roth, 1993) is available from the end of the first year and manifests itself through joint attention, and somewhat later, early pretend play.

For Hobson (1989b; 1993a,b), the developmental precursors to sharing attention are those that lead to an understanding of persons as subjects, and he argues that whilst the capacity for visual referencing contributes to this, an earlier-developing inability to grasp the directedness of their own and other people's feelings underlies both joint attention, and later-developing theory of mind, impairments in autism. Tantam (1992) proposes that an early acquired abnormality of "social gaze response" underlies both joint attention and later social-communicative impairments in autism, including the

failure to acquire a theory of mind.

5.4 EXPERIMENT 3

Design

Two sets of joint attention tasks were given, at different times during the testing session. A series of three *joint attention* tasks, based closely on those described by Butterworth and Adamson-Macedo (1987), were given in the invariant order described below. A series of *goal detection* tasks, as described by Phillips et al. (1992), were given at appropriate moments throughout the testing session.

5.4.1 Joint attention tasks (after Butterworth and Adamson-Macedo, 1987)

Method

The child stood or sat between their mother and the experimenter. If possible, the child's non-dominant hand was held by their mother (to allow for pointing responses, but to restrict the child's movement towards the target object). A series of 3 mechanical toys, designed to provoke an ambiguous response - that is, to provoke a mixture of attraction and uncertainty in the child - were placed one by one onto the floor of the room 1 to 2 metres from where the child was sitting, or standing. Each toy display comprised one trial. The toys were a robot, which flashed and beeped and moved around in circular sweeps; a car which followed a circular path around the

room; and a pig which made "oinking" noises and shunted backwards and forwards.

The toys were controlled by the experimenter via a control box and an electrical lead which ran from the box to the toy. For each toy, the following sequence of the toy being active and inactive was followed:

1. The toy was active for 30 seconds.
2. The toy was inactive for 15 seconds.
3. The toy was active for 15 seconds. If the child had made no pointing response to the toy by this stage, the following prompt was given: "Where's the robot/pig/car?".

Scoring

The child and mother were filmed head on, so that looks by the child to either their mother or the experimenter, and gestures directed to the target object, to their mother or to the experimenter, could be recorded. The following actions were scored as either present or absent for each trial:

1. Infant looked to mother
2. Infant looked to experimenter
3. Infant looked to control box
4. Infant pointed to target object
5. Infant reached towards target object

6. Infant vocalised.

In addition, if the child pointed to the target object, the sequence of looking and pointing was recorded i.e. did the child look (i) before, (ii) during, or (iii) after pointing?

Inter-rater reliability

24 of the joint attention trials were rated by a second rater across all six measures taken. The inter-rater reliabilities for the joint attention measures, expressed in terms of percentage agreement, and as measured by Cohen's kappa (Cohen, 1960), are shown in Table 5.1. Across all 6 measures, measured in percentage terms the mean agreement was 87% (range 75% to 96%), and as measured by kappa 0.73 (range 0.47 to 0.92).

5.4.2 Goal detection tasks (after Phillips et al., 1992)

Method

(a) The blocking task.

When child was manually and visually engaged with a toy, the experimenter covered the child's hands with their own, preventing the child from further activity, and holds the block for 5 seconds. This was repeated 4 times during the session.

(b) The teasing task.

The experimenter offered the child a toy. When the child looked at the toy and began to reach for it, the experimenter withdrew the toy and held it out of reach for 5 seconds. The experimenter then gave the toy to the child. This was repeated 4 times during the session.

Scoring

From the video, it was recorded whether the child looked up towards the experimenter's eyes during the 5 second period immediately after the block or tease.

Inter-rater reliability

34 of the goal detection trials were rated by a second rater. The inter-rater reliabilities for the goal detection measures, expressed in terms of percentage agreement, and as measured by Cohen's kappa (Cohen, 1960), are shown in Table 5.1. Measured in percentage terms the mean agreement was 97% (range 94% to 100%), and as measured by kappa 0.94 (range 0.88 to 1.00).

5.5 RESULTS

5.5.1 Joint attention tasks

The proportion of completed trials on which subjects produced the six keys actions was scored from the videotapes (see Section 5.4.1), and are shown in Tables 5.2 and 5.3. Not all subjects completed all three joint attention trials due to non-cooperation and occasional malfunctioning of the mechanical equipment. However, there was no significant difference between the mean number of trials completed by each group (ANOVA, $F(2,45) = 0.21$, $p = ns$). The mean number of trials completed by subjects in each group is shown in Table 5.3.

The data was analyzed by ANCOVA, with CA, NVMA and LA entered as covariates. There were significant differences between the groups on three variables: look to caregiver, look to experimenter, and look to either adult (caregiver or experimenter). For looks to caregiver there was a main effect for group, with no effects for covariates (ANCOVA, $F(2,42) = 4.38$, $p < 0.02$). Post-hoc specific comparisons revealed that children with autism looked to their caregiver significantly less than developmentally delayed children ($t\text{-value} = 2.86$, $p < 0.008$). Similarly, for looks to experimenter there was a main effect for group, with no effect for covariates (ANCOVA, $F(2,42) = 18.1$, $p < 0.001$). Post-hoc specific comparisons revealed that children with autism looked

Table 5.1 Inter-rater reliability for joint attention measures

	Percentage agreement	Kappa
Joint attention task		
Look to mother	96	0.90
Look to experimenter	88	0.75
Look to box	96	0.92
Point	75	0.47
Reach	88	0.71
Vocalise	81	0.61
Goal detection task		
Blocking	94	0.88
Teasing	100	1.00

less to the experimenter than children from both the developmental delay and normal groups (t -value = 5.91, $p < 0.001$; and t -value = 3.79, $p < 0.001$; respectively). For the combined score of looks to either adult, there was a significant main effect for group (ANCOVA, $F(2,42) = 26.9$, $p < 0.001$) and no covariate effects. Post-hoc specific comparisons revealed that children with autism looked less to the experimenter than children from both the developmental delay and normal groups (t -value = 7.33, $p < 0.001$; and t -value = 3.45, $p < 0.002$; respectively). There was no group difference in the proportion of trials in which children looked to the box which controlled the mechanical toys. There were also no group differences for the percentage of completed trials on which children pointed, reached or vocalised, and no covariate effects.

As a more generous measure of joint attention behaviours produced across all trials, the number of subjects who produced the key behaviours *in at least one trial* was calculated. These results are shown in Table 5.4. Although nearly one-third of the children with autism looked to either their caregiver or to the experimenter on at least one trial, this was significantly less than the children with developmental delay and the normal children, all of whom looked to either the experimenter or a caregiver on at least one trial ($X^2 = 29.8$, $p < 0.001$; Fisher's exact: A x DD $p < 0.001$; A x N $p < 0.001$; DD x N = ns). On the two other measures to show group differences - production of pointing and vocalisation - the normal children scored more highly than the children with autism (Pointing: $X^2 = 8.76$, $p < 0.02$; Fisher's exact: A x DD = ns; A x N $p < 0.006$; DD x N = ns; Vocalisation: $X^2 = 9.07$, $p < 0.02$; Fisher's exact: A x DD = ns; A x N $p < 0.005$; DD x N = ns). There were no group differences on the number of children who reached towards the toy on at least one trial.

Post-hoc comparisons comparing the mean CA, NVMA, and LA of the children in each group who produced each key joint attention behaviour, with that of children who did not, were conducted. Due to the multiple comparisons this involved, a conservative level of significance of $p < 0.01$ was adopted, in order to minimise the risk of false positives, or Type I errors. For all groups across all key behaviours these comparisons did not reach significance (all ANOVA = ns), indicating that within each group children who produced the key joint attention behaviours did not have a higher CA, NVMA, or LA, than children who did not.

Pointing during the trials was relatively rare, being produced by only 1 child with autism, 5 children with developmental delay, and 10 of the normal children. The occurrence of pointing was too low to enable a meaningful analysis of the sequence of looks and points, such as that conducted by Franco and Butterworth (1988; 1991), to be carried out.

5.5.2 Goal detection tasks

The proportion of completed blocking and teasing trials on which subjects made eye contact with the experimenter was scored from the videotapes, and are shown in Table 5.5. The mean number of trials completed by subjects in each group is also shown in Table 5.5. Not all subjects completed all four blocking and four teasing trials, due to non-cooperation and time constraints. However, there was no significant difference between the mean number of trials completed by each group in either the blocking (ANOVA, $F(2,45) = 0.17$, $p = ns$) or the teasing trials (ANOVA, $F(2,45) = 1.20$, p

= ns).

The data was analyzed by ANCOVA, with CA, NVMA and LA entered as covariates. There was no significant group or covariate effect for blocking, but a significant main effect for group for teasing, with no effects for either covariate (ANCOVA, $F(2,42) = 3.93$, $p < 0.03$). Post-hoc specific comparisons revealed that children with autism looked less to the experimenter than children from developmental delay group ($t\text{-value} = 2.79$, $p < 0.009$).

In addition, "reliable" and "unreliable" performance by children across all three groups was identified using a cut-off of making eye contact with the experimenter in at least 50% of trials completed. This cut-off also allowed direct comparison with Phillips et al.'s (1992) data. The percentage of each group who made eye contact on at least 50% of completed blocking and teasing trials are shown in Table 5.6. Non-parametric analysis demonstrated that the developmental delay and normal groups included significantly more children who "reliably" made eye contact in the blocking and teasing trials (blocking: $X^2 = 13.1$, $p < 0.002$; Fisher's exact: $A \times DD$ $p < 0.04$; $A \times N$ $p < 0.001$; $DD \times N = ns$; teasing: $X^2 = 12.1$, $p < 0.003$; Fisher's exact: $A \times DD$ $p < 0.003$; $A \times N$ $p < 0.004$; $DD \times N = ns$). Post-hoc comparisons comparing the mean CA, NVMA, and LA of the children in each group who made eye contact in greater, or fewer, than 50% of the blocking and teasing trials were conducted. Due to the multiple comparisons this involved, a conservative level of significance of $p < 0.01$ was adopted, in order to minimise the risk of false positives, or Type I errors. Only one analysis reached significance: The 13 children in the developmental delay

group who made eye contact on 50% or more of the teasing trials had a higher NVMA than the 5 children who made eye contact on less than 50% of the teasing trials (mean = 18.6, s.d. = 1.6, and mean = 15.8, s.d. = 1.7, respectively, ANOVA $F(1,16) = 10.9$, $p < 0.005$).

5.6 DISCUSSION

5.6.1 Joint attention tasks

The children with autism showed specific impairments in the amount of joint attention behaviour produced. On the composite measure of 'look to either adult' they produced looks on less than 20% of trials, compared to looks to either adult on 86% of trials by both children with a developmental delay, and normal controls. On the most generous measure of look to adult on at least one trial (and all children completed 2 or 3 trials) only one third (31%) of the children with autism produced at least one look, compared to 100% of the controls. However, there were no group differences on the measure of looking to the box that controlled the toys. This was intended to be a control measure of instrumental looking - since most children seemed to be aware that the box controlled the toys and looked at it when the toy was stopped and restarted during the one minute sequence of stops and starts. In sum, there was no evidence that children with autism were looking less overall - merely that they produced less social and communicative looks. These findings support those of many previous studies which have shown specific deficits in the social use of gaze, with no

Table 5.2 Proportion of trials on which key behaviours observed by diagnostic group

	Look to caregiver x (sd)	Look to expt. x (sd)	Look to either adult x (sd)	Look to box x (sd)
Autism n = 13	0.04 (0.13)	0.09 (0.17)	0.17 (0.30)	0.40 (0.33)
Developmental delay n = 18	0.43 (0.39)	0.74 (0.33)	0.86 (0.22)	0.49 (0.40)
Normal n = 17	0.46 (0.37)*	0.68 (0.33)*	0.86 (0.24)*	0.48 (0.39)
<hr/>				
+ANCOVA	Main effect of GROUP F (2,42) = 4.38 p < 0.02 Covariate effect: CA, NVMA, LA F (1,42) = ns			
# ANCOVA	Main effect of GROUP F (2,42) = 18.1 p < 0.001 Covariate effect: CA, NVMA, LA F (1,42) = ns			
* ANCOVA	Main effect of GROUP F (2,42) = 26.9 p < 0.001 Covariate effect: CA, NVMA, LA F (1,42) = ns			

Table 5.3 Proportion of trials on which key behaviours observed by diagnostic group

	Point	Reach	Vocalise	Mean number of completed trials
	x (sd)	x (sd)	x (sd)	x (sd)
Autism n = 13	0.03 (0.09)	0.08 (0.20)	0.09 (0.17)	2.62 (0.51)
Developmental delay n = 18	0.19 (0.35)	0.27 (0.36)	0.23 (0.31)	2.72 (0.46)
Normal n = 17	0.37 (0.37)	0.30 (0.36)	0.50 (0.37)	2.71 (0.47)

Table 5.4 Production of key behaviours on at least one trial by diagnostic group

	n	Look to either adult	Point	Reach	Vocalise
Autism	13	30.8%	7.7%	15.4%	23.1%
Developmental delay	18	100%	27.7%	44.4%	44.4%
Normal	17	100%*	58.8%*	52.9%	76.5%*
<hr/>					
+ $X^2 = 29.8$ $p < 0.001$ [Fisher's exact: A x DD $p < 0.001$; A x N $p < 0.001$; DD x N = ns] # $X^2 = 8.76$ $p < 0.02$ [Fisher's exact: A x DD = ns; A x N $p < 0.006$; DD x N = ns] * $X^2 = 9.07$ $p < 0.02$ [Fisher's exact: A x DD = ns; A x N $p < 0.005$; DD x N = ns]					

Table 5.5 Proportion of blocking and teasing trials on which children made eye contact by diagnostic group

	Blocking x (sd)	Mean trials completed x (sd)	Teasing x (sd)	Mean trials completed x (sd)
Autism n = 13	0.30 (0.42)	3.69 (0.63)	0.19 (0.37)	3.08 (1.04)
Developmental delay n = 18	0.65 (0.45)	3.78 (0.55)	0.63 (0.38)	3.44 (1.10)
Normal n = 17	0.69 (0.31)	3.65 (0.79)	0.65 (0.42)*	3.65 (0.68)

* ANCOVA

Main effect of GROUP $F(2,44) = 3.93$ $p < 0.03$
Covariate effect: CA, NVMA, LA $F(1,44) = ns$

Table 5.6 Percentage of each group who made eye contact on at least 50% of completed blocking and teasing trials.

	n	Blocking	Teasing
Autism	13	23.1%	15.4%
Developmental delay	18	61.1%	72.2%
Normal	17	88.2% ⁺	70.6% [#]

⁺ $X^2 = 13.1$ $p < 0.002$ [Fisher's exact: A x DD $p < 0.04$; A x N $p < 0.001$; DD x N = ns]
[#] $X^2 = 12.1$ $p < 0.003$ [Fisher's exact: A x DD $p < 0.003$; A x N $p < 0.004$; DD x N = ns]

differences in instrumental gaze, nor in the total amount of gaze overall (Baron-Cohen, 1989c; Dawson et al., 1990; Mundy et al., 1993; Phillips et al., 1992; Sigman et al., 1986).

On the other behaviours measured - pointing, reaching, and vocalising - group differences were less clear. Whilst there were no differences on the proportion of trials on which these behaviours occurred, and indeed the incidence of pointing and reaching was low overall, when measured in terms of production of the key behaviours on at least one trial group differences did emerge. The normal children produced more points and vocalisations than the children with autism, although the children with developmental delay differed from neither of the other groups. In fact only one child with autism pointed, against one quarter of the developmental delay controls and over one half of the normal children. Butterworth (1991; Butterworth and Adamson-Macedo, 1987) has shown that pointing is a later-emerging, more mature joint attention behaviour than joint gaze, which begins to emerge in normal development around the 14th month in infancy. The relatively low level of these more mature joint attention behaviours produced by the autism and developmental delay groups, with mean NVMA's of 17 to 18 months, may reflect their developmental maturity, and fits with Butterworth's data from studies with normally-developing infants (Butterworth, 1991; Butterworth and Jarrett, 1991).

How do the present results compare to past studies? Although Mundy et al. (1986) present their data in terms of frequencies and durations of joint attention behaviours, making direct comparison difficult, their findings were similar. They found that the

best discriminator between the autistic and control groups, from more than 20 measures coded on the Early Social Communication Scale (Seibert and Hogan, 1982), was eye contact whilst a mechanical toy was active. The also found that production of pointing in their sample of 53-month-old children with autism (with a Cattell MA of 26 months and Merrill-Palmer MA of 34 months) did not clearly discriminate between their groups. In a very different experimental set up, where children were filmed for 45 minutes during a period of play with peers, and employing older and more able children with autism, Baron-Cohen (1989c) found that none of the children with autism produced protodeclarative pointing, whilst 40% produced protoimperative pointing. Whilst the overall production of pointing across all three groups was not frequent enough in the present study to separately code for protodeclarative and protoimperative pointing, it is apparent that the children with autism produced very little pointing at all. A judgement was made from the videotapes of whether the points produced by the control children were imperative or declarative in their function. From the total number of points produced by all subjects only 2 were rated as imperative. However, overall the earlier-emerging capacity for joint visual attention more clearly discriminated between the groups than production of pointing, and was the only measure on which an autism-specific deficit was reliably found.

5.6.2 Goal detection tasks

On the goal-detection tasks the children with autism produced looks to the experimenter's face in 30% of blocking trials, but only 19% of teasing trials. Both control groups produced looks on over 60% the trials completed. This difference was

significant for the teasing trials, but failed to reach significance for the blocking trials. Using the cut-off for "reliable" looks, employed by Phillips et al. (1992), of looking on at least 50% of trials, there were significant autism-specific groups differences on both the blocking and teasing trials. Hence, although there were autism-specific impairments on both tasks, performance on the teasing trials more reliably dissociated the autism group from the controls. Comparing these results to those of Phillips et al. (1992), the present results are shown to be broadly similar. Whilst compared to the Phillips et al. (1992) study, the children with autism in the present study performed slightly better, and both control groups slightly more poorly, autism-specific impairments in employing eye contact to detect an agent's goal were still apparent. Although Phillips et al. (1992) found that 100% of their sample of normal children with a mean CA of 14 months looked on 50% or more of the trials, compared to 88% in the blocking and 71% in the teasing trials in the present experiment, respectively, the performance of the mental handicap controls and children with autism in the present study was broadly similar to that in Phillips et al.'s (1992) study. In addition, in both studies there were more clear differences on the teasing trials, compared to the blocking trials. This may be due to the greater ambiguity inherent in the task. Blocking a child's reach for an object can have an instrumental function (e.g. to stop the children picking up a dangerous or delicate object), whereas teasing is a deliberately ambiguous and playful (or spiteful) action. The greater uncertainty inherent in the ambiguous tease situation may be more likely to elicit a social look in order to clarify the adult's goal. Baron-Cohen et al. (in press) have also found that children with autism do not appreciate that eye direction gives a clue to the goal of an agent.

5.6.3 Implications for the status of joint attention as a precursor to a theory of mind

Across both tasks the children with autism showed severe and consistent impairments in their use of joint attention behaviour, particularly gaze to detect goal or share experience of an ambiguous event. These results fit with both Baron-Cohen's (1993, 1994) and Mundy and Sigman's (Mundy et al., 1993) accounts of joint attention as a developmental precursor to a theory of mind. Whilst the present study does not allow us to test one of these theories against the other, a closer examination of how the present results fits with past findings may enable us to compare whether the present results better support one or other theory.

Baron-Cohen (1989c) suggested that representing the goal of shared and differing attention between people may be an important step towards representing shared and differing thoughts and beliefs (Baron-Cohen and Cross, 1992). In his most recent exposition of his thesis Baron-Cohen (1994) details the architecture of the developmental precursors of a theory of mind in more detail. As mentioned above, he focuses on joint attention, in the form of the Shared Attention Mechanism (SAM), as the fulcrum of his model. Charman (1994b) has criticised the separation that Baron-Cohen delineates between SAM and ToMM, since both may involve representing the *attitude* of the other agent. In fact, Baron-Cohen (1991c; 1993) has also written that the concepts of goal and attention may function for the 9 to 12-month-old as a simple theory of mind, allowing the idea that SAM and ToMM may be developmentally different demonstrations of the same underlying mechanism, rather than separable

mechanisms as he suggests in his most recent exposition (Baron-Cohen, 1994). However, the present research confirms Baron-Cohen's main thesis, in that it has demonstrated that the autism-specific impairment in joint attention skills holds for 20-month-old children with autism, and may characterise their fundamental cognitive or affective deficit, that is latter apparent as an impaired theory of mind.

Mundy and Sigman's (1989; Mundy et al., 1993) account differs from Baron-Cohen's in the explicit role they give to both cognitive and affective factors in joint attention behaviour, and its impairment in autism. They highlight the role of the expression and comprehension of affect in the development of joint attention and symbolic play skills, and the eventual development of a theory of mind. They argue that affect is a unique source of information about the covert aspects of others' behaviour, and that via a process of comparing proprioceptive affective information with the perceived affective information from the other (similar to that suggested by Meltzoff and Gopnik (1993) for imitation, see Section 6.3) joint attention provides the child with affective, as well as visual, information, and that from this an appreciation of the mentalistic stance of self and others is built.

The present study did not include measures of affect comprehension or expression (although the empathy and attachment tasks in Chapter 3 include such measures), and so cannot contribute directly to the support or refutation of their theory. However, both joint attention tasks were designed to include some element of affective valence: the mechanical toys in joint attention trials were designed to be unfamiliar and ambiguous; the blocking and (especially) the teasing task were designed to provide

ambiguous goals to the child. The only clear difference between performance by the groups across the joint attention tasks employed was that the children with autism showed their most intact performance on the blocking goal detection trials, where there were no group differences on the overall proportion of trials on which the children looked to the experimenter. As suggested above, this task may have less of the ambiguity than the teasing trial, since impeding a child's reach could have an instrumental goal, whereas teasing could not. It may be that when a task involves low affective valence, or low ambiguity of goal, children with autism do produce some joint attention behaviour. Once again, their intact performance on tasks which measure visual perspective-taking (Baron-Cohen, 1989c, 1991c; Hobson, 1984), as well as their intact performance on looking at the control box in the present study, may be more *instrumental* and not *social* gestures, and are hence soluble by children with autism.

Whilst this is only a suggestion, and the present results do not strongly support Mundy and Sigman's account of the joint-attention deficit in autism over Baron-Cohen's, the inclusion of measures of the affective components in experimental work with children with autism will be crucial to resolving the debate regarding the role of affect in the joint attention and theory of mind deficits in autism.

In summary, the present experiment confirms the previous findings that children with autism have a specific impairment in their joint attention ability. The results do not rule out (and are consistent with the notion) that joint attention acts as a precursor to a theory of mind.

CHAPTER SIX:

IMITATION

6.1 IMITATION IN INFANCY

6.1.1 Early accounts of imitation in infancy

Two competing theories of imitation had gained wide acceptance amongst developmental psychologists by the 1960s. On the one hand, some theorists asserted that imitation is based on early learning. That is, the stimulus-response linkages manifest in imitative acts are built up through conditioning and learned associations (Bandura, 1969). In this view, infants are taught to imitate simple acts in everyday interactions with caregivers. However, this theory was challenged on the grounds that learning could not account for the observation that infants also imitate behaviours that have not been part of any previous adult-infant interactions. Piaget (1962) outlined an alternative view, that imitation relied on gradually developing cognitive and perceptual abilities, and developed slowly during infancy. Piaget (1962) singled out facial imitation as a significant developmental milestone, because unlike manual and vocal imitation, the infant's response cannot be perceived within the same sensory modality as the model's. In other words, the stimulus and response cannot be directly compared. Piaget claimed that this was beyond the perceptual-cognitive competence of infants younger than 8-12 months of age. It is not that younger infants are nonimitative, but

that only simple, visible actions are imitated before this time.

6.1.2 Neonatal imitation of facial gestures

These theories were dramatically challenged by the demonstration of imitation of tongue protrusion, mouth opening and lip protrusion by 12- to 21-day-old infants (Meltzoff and Moore, 1977). A subsequent study replicated these findings and showed that the capacity was innate, by using subjects with a mean age of 32 hours old, with the youngest subject being 42 minutes old at the time of testing (Meltzoff and Moore, 1983). Whilst some initial attempts to replicate these findings in other laboratories were unsuccessful, and others took issue with the methodology and interpretation used by Meltzoff and Moore (e.g. Hayes and Watson, 1981), there have been many replications of the finding in over ten laboratories over the past decade, and neonatal imitation is now a widely accepted phenomenon (Dunkeld, 1978; Field, Woodson, Greenberg and Cohen, 1982; Heimann and Schaller, 1985; Heimann, Nelson and Schaller, 1989; Kugiumutzakis, 1985; Maratos, 1973; Meltzoff and Moore, 1977; 1983, 1989, Wolff, 1987; see Heimann, 1991; and Meltzoff and Moore, 1992; for reviews). Imitation of tongue protrusion and mouth-opening in infants less than two-months-old have been widely replicated, and imitation has also been reported for emotional expressions, and a variety of other gestures, including eye-blinking, cheek movements and hand gestures. Reliable individual differences have been found in the tendency to imitate in young infants (Heimann, 1989, 1991), as well as in the specificity of imitative response to people, with inanimate objects failing to yield matching responses (Abravanel and DeYong, 1991; Legerstee, 1991).

Several theories have been put forward to explain the phenomenon of neonatal imitation. If infants had been shown to match the adult only during the gestural demonstration, infant tracking responses, or perceptual tethering, might explain their imitative responses. However, Meltzoff and Moore (1989) demonstrated that infants showed significant matching not only during the period when the adult was modelling the gesture, but also during the passive-face periods. In addition, infants were able to initiate their matching response, to begin it for the first time, even after the adult movement had ceased. These results suggest that tracking cannot explain neonatal imitation. Another theory, that of early learning, can be excluded since neonatal imitation of facial gestures has been repeatedly demonstrated with subjects only a few hours or days old (Meltzoff and Moore, 1983: 42 minutes to 72 hours; Field et al., 1982: less than 36 hours old; Kugiumutzakis, 1985: less than 40 hours old). A third possible explanation is that the simple facial gestures are imitated by neonates due to the operation of an innate releasing mechanism. However, several different types of gesture have been shown to be imitated by neonates (tongue protrusion, mouth opening, eye blinking, cheek movements, hand movements) and the list is lengthening. Whilst it would be parsimonious to explain the presence of one or two specific imitative capabilities by the operation of innate releasing mechanisms, the number of different types of facial and non-facial gestures imitated by neonates makes this explanation unlikely. In addition, the responses that have been imitated do not have the stereotypic, rigid morphology and temporal organisation characteristic of released reactions, or "fixed-action patterns".

The theoretical explanation of the phenomenon of neonatal imitation which has been

most influential, and which underlies the notion that imitation is a precursor of a theory of mind, is that put forward by Meltzoff and Moore (1983, 1989, 1992). They propose that neonates have some underlying ability to recognise and use the equivalences between body movements they see and the physical actions of their own bodies, in other words, an inter- or cross-modal equivalence matching. At some level of processing infants are able to apprehend the equivalences between body transformations they see and body transformations of their own that they proprioceptively "feel" themselves make. One possible mechanism to explain this ability is that infants can represent human movements patterns they see and ones they perform using the same internal code, which must be non-modality-specific. Meltzoff and Moore's theory is described in more detail later (see Section 6.3).

6.1.3 Further developments in infant imitation research

Two strands of empirical investigation have developed from this work on neonatal imitation. First, Meltzoff has investigated the development of imitation of acts performed on objects, or procedural imitation, by infants (1988a). Second, several investigators have examined the relationships between imitation and other social cognitive abilities (Heimann, 1991; Meltzoff and Moore, 1992).

Meltzoff (1988a,b) chose to examine both immediate and delayed imitation of novel acts on objects. He found that 9-month-old infants were able to imitate actions both immediately after the action was modelled, and after a 24 hour delay. These experiments employed *unfamiliar* objects, which required *novel* actions to be imitated.

Meltzoff's experiments included methodological features which represented significant advances in the scientific study of imitation in development. Meltzoff demonstrated the validity of these tasks by using a "baseline" control condition which involved the objects being presented with no action being demonstrated, and an "adult-manipulation" control condition where the toy is picked up but where the target actions are not shown. In contrast to the imitation condition, neither of these control conditions produced repetition of the critical imitative acts. These tasks are employed in Experiment 4 (see Section 6.4). In a further study with 14-month-olds, intact imitation of procedural acts was demonstrated after a delay of one week (Meltzoff, 1988b). Meltzoff (1990) highlights the theoretical importance of imitation of novel acts after a lengthy delay. If the infant is limited to immediate mimicry, imitation can only play a limited role in broadening the self's repertoire, and in long-term changes in the self. If, however, infants have some *representational capacity* allowing them to "read out" at a later time the information previously picked up from the other, imitation could have significant value in social cognitive development.

Meltzoff and Moore (1992) investigated the apparent "drop out" of imitation between 6 weeks and 3 months of age. They found no loss of imitation of facial gestures between these ages. They proposed that the social and psychological functions which imitation serves change over development, and argued that infants deploy imitation to enrich their understanding of persons and actions, and that early imitation is used for communicative purposes. Infants use the nonverbal behaviour of people as an identifier of who people are, and they use imitation as a means of verifying this identity. Heimann (1989) has provided the first empirical evidence for the relationship

between imitation and later social behaviour. He demonstrated that imitation at 2-3 days and 3 weeks of age was negatively correlated with gaze aversion in a social interaction with mother at 3 months of age. Thus, children showing a high level of imitation tend to show fewer instances of gaze aversion - in other words more socialised behaviour in the interaction with mother. The central role for imitation in the development of social cognition ascribed by Meltzoff and his colleagues is discussed in more detail later (see Section 6.3).

Meltzoff (1990) summarises the three types of experimental research into imitation in normally-developing infants as involving (a) "social modelling" (in which infants produce matching behaviour of an adult), (b) "self-practice" (also called "deferred imitation", or imitating after an extended delay) and (c) "social mirroring" (which occurs when infants recognise an adult's behaviour matches their own). Meltzoff argues that these form a developmental pattern reflecting increasing memory load and representational complexity. Although there is substantial evidence that the ability for social modelling is present in neonates (Meltzoff and Moore, 1983, 1989, 1992), evidence for the ability for deferred imitation of actions after a 24 hour delay has not been reported below 9 months of age (Meltzoff, 1988a), and social mirroring has only been demonstrated from 14 months of age (Meltzoff, 1990).

6.2 IMITATION IN AUTISM

6.2.1 An overview

The majority of studies conducted to date have concluded that children with autism are impaired in imitation, relative to mental-age matched controls (see Meltzoff and Gopnik, 1993; and Rogers and Pennington, 1991, for recent reviews). However, clinicians and teachers often express surprise at the idea of an imitation deficit, citing the fact that children with autism would not be able to benefit as they do from many educational programmes without a capacity for imitation, since these almost always entail modelling by the teacher. The occurrence of echolalia is also often cited as clear evidence against an imitation deficit in autism. Although not a feature of Kanner's original description (Kanner, 1943), abnormal imitation has nevertheless become widely accepted as a feature of the syndrome. Thus, both DSM-III-R (APA, 1987) and ICD-10 (WHO, 1992) include impaired imitation amongst the diagnostic criteria for autism. The experimental evidence for an autism-specific deficit in imitation will be reviewed in detail in this section.

In terms of Meltzoff's (1990) classification of imitation into social modelling, self-practice, and social mirroring, the experimental research in autism to date falls mostly into the category of social modelling. No studies have looked at the developmentally intermediate imitative ability of deferred imitation. The few studies that have investigated social mirroring have demonstrated that children with autism *do* recognise when their actions are being mirrored (Dawson & Adams, 1984). Social modelling

studies have tended to use the *vocal* and *gestural imitation* items from the Uzgis and Hunt (1975) sensorimotor development scales, or similar gestures (Charman and Baron-Cohen, 1994a; Curcio, 1978; Dawson and Adams, 1984; Jones and Prior, 1985; Morgan, Cutrer, Coplin and Rodrigue, 1989; Sigman and Ungerer, 1984; Wetherby and Prutting, 1984). A few others have examined imitation of manipulation of objects (or *procedural imitation*) (Charman and Baron-Cohen, 1994a; DeMyer et al., 1972; Hammes and Langdell, 1981; Heimann, Ullstadius, Dahlgren and Gillberg, 1992). These two forms of imitation in autism are reviewed next.

6.2.2 Gestural imitation in autism

DeMyer et al. (1972) found that subjects with autism were impaired, relative to mental-age matched controls, in both imitation of body movements and actions on objects. Curcio (1978) found that whilst subjects with autism were able to solve object permanence tasks, their imitation of gestures, particularly facial gestures, was poor. Hammes and Langdell (1981) concluded that children with autism could perform imitation at the most basic level but were not able to imitate symbolic gestures. Sigman and Ungerer (1984b) demonstrated autism-specific deficits in the execution of both motor and vocal imitation tasks from the Uzgis and Hunt Sensorimotor Scales (1975). Similar findings were obtained by Jones and Prior (1985) and Ohta (1987) using imitation of body movements. Dawson and Adams (1984) also found that whilst there was a range of imitative ability in their sample of children with autism, their performance on the imitation scales of the Uzgis-Hunt was significantly behind their performance on the object permanence scales. In addition, intact imitative

responses were most likely for familiar (learnt?) action patterns.

More recently, Rogers and McEvoy (1993) found that whilst high-functioning adolescents with autism were able to imitate familiar, meaningful (symbolic) movements, they were severely impaired, compared to controls, in imitating unfamiliar, novel actions. Heimann et al. (1992) also found a range of imitative ability in children with autism, and variability across a range of tasks, although the subjects with autism in their pilot study did not perform as well as CA and MA-matched comparison groups. This is consistent with Hertzig, Snow and Sherman (1989), who found that subjects with autism were poorer than control groups at imitating both sensorimotor and symbolic actions of a model.

On the other hand, there have been several studies which have obtained contradictory findings. Thatcher (1977) found that children with autism could pass the gestural and vocal imitation items from the Uzgiris and Hunt (1975) Scales at a mental-age appropriate level, although no comparison groups were employed in their study. Consistent with Thatcher's study, Morgan et al. (1989) also found no gestural or vocal imitation deficit in a group of children with autism, compared to matched controls. Charman and Baron-Cohen (1994a) also found that children with autism were able to imitate gestures as well as mental-aged matched controls. A recent study has also shown relatively intact imitation of facial gestures in adolescents and adults with autism (Loveland et al., 1994). Morgan et al. (1989) suggest that their positive result may reflect the fact that their sample of children with autism were older (mean CA: 101 months) and had a higher mental age (mean VMA: 36 months) than the subjects

employed by Sigman and Ungerer (1984b). Could this account for variability in the results obtained over different studies? Whilst Sigman and Ungerer's subjects were younger (mean CA: 52 months) and less able (mean MA: 25 months) than in many of the studies reported, other studies which have demonstrated an impaired ability in children with autism have used older and more able subjects (DeMyer et al., 1972: CA 67 months, VMA 31 months; Curcio, 1978: CA 97 months; Jones and Prior, 1985: CA 103 months, VMA 52 months; Rogers and McEvoy, 1993; CA 186 months, VIQ 85). On the face of it, therefore, neither CA nor MA appear to explain the variability of the results in imitation in autism.

As mentioned earlier, most studies have employed the vocal and gestural imitation items from the Uzgiris and Hunt Sensorimotor Scale (1975). The gestural imitation scale employs a hierarchy of tasks which increase in complexity, and for which the age norms for passing range from 7 months to 20 months. The lower items in the Scale involve imitation of simple familiar gestures (e.g. clapping hands, age norm 7 months). In the middle of the scale, items involve imitation of unfamiliar, visible gestures (e.g. bending a finger to right angles, age norm 11 months). The higher items involve imitation of unfamiliar, invisible gestures (e.g. pulling down on one's ear lobes, hitting hands on the back of one's head, age norm 14-20 months). It may be that the positive results obtained by Thatcher (1977), Morgan et al. (1989) and Charman and Baron-Cohen (1994a) reflect ceiling effects, as a result of the developmental limits of the Uzgiris-Hunt Scale. However, the possibility that the development of imitation in autism is significantly delayed but does eventually develop should not be discounted.

6.2.3 Procedural imitation in autism

We now turn to review the evidence concerning imitation of actions on objects. The term "procedural imitation" will be used to refer to this. This has been tested less frequently. DeMyer et al. (1972) selected motor-object imitation tasks from developmental assessment scales. These included a wide range of tasks such as stirring a spoon in a cup, buttoning two buttons, and kicking a ball. These are familiar gestures which are used in play and which the child may well have practised, and indeed have been encouraged to have perform, previously. DeMyer and her colleagues found that children with autism performed more poorly than controls on imitation tasks, particularly those involving imitation of body movements. More recently, Heimann et al. (1992), and Hammes and Langdell (1981), also employed imitative acts which involved functional and symbolic actions on familiar toys. Both studies found that whilst there was some variability in imitation ability, subjects with autism performed more poorly than controls. However, it is clear that these studies may confound familiar play routines with "pure" imitation, and hence merge the boundaries between imitation and play. A poor performance on these tasks by children with autism may reflect abnormalities in either their functional or symbolic play (Baron-Cohen, 1987; Jarrold et al., 1993; Lewis & Boucher, 1988), rather than an imitation deficit per se. Alternatively, a good performance may reflect well-established play routines rather than imitative ability, similar to the demonstrated intact imitation of familiar and meaningful gestures described above (Dawson and Adams, 1984; Rogers and McEvoy, 1993).

Charman and Baron-Cohen (1994a) used the tests of procedural imitation that Meltzoff (1988a,b) developed in his work with 9-month-old normal children, which employ *unfamiliar* objects and which require *novel* actions to be imitated. Their methodology, and the specificity with which the acceptable response for imitation was defined, overcame some of the confusion inherent in other studies where it is not clear whether imitation, or some other response, is being produced. Their school-aged subjects with autism demonstrated an intact ability to imitate on these procedural tasks (Charman and Baron-Cohen, 1994a). In addition, other studies have demonstrated intact ability in autism to imitate familiar, learnt routine gestures (Dawson and Adams, 1984; Rogers and McEvoy, 1993). Recent work with Down's syndrome children with a mental handicap using these tasks (Rast and Meltzoff, 1991) has indicated that their imitative skills develop in line with their mental age.

No clear explanation for the variation in experimental findings across different studies has been proposed. Whilst it has been established in at least some studies that imitation skills are intact in autism, the question remains whether they are specifically delayed. The subjects with autism in Charman and Baron-Cohen's (1994a) study had a mean VMA of 46 months, and only 3 subjects had VMA scores under 24 months. Meltzoff has demonstrated competence on the procedural tasks they employ in infants as young as 9 months old (Meltzoff, 1988a), and the age norm for passing even the most difficult of the gestural imitation tasks given by Uzgiris and Hunt is 20 months. Charman and Baron-Cohen (1994a) conclude that whilst the development of early-emerging imitation skills (which nevertheless involve invisible and unfamiliar gestures) may be specifically delayed in autism, they are clearly not wholly absent.

In this sense, a specific developmental delay hypothesis of imitation in autism is not ruled out.

6.3 THEORETICAL ACCOUNTS OF IMPAIRED IMITATION IN AUTISM

6.3.1 Early explanations of impaired imitation in autism

Early explanations which attempted to account for the experimental findings that children with autism were impaired, or at least developmentally delayed in their ability to imitate, utilised the Piagetian notion of symbolic development during infancy. Hammes and Langdell (1981) concluded that children with autism are able to imitate at a basic level - to form internal images of external objects and events - but that they tend to remain "stimulus bound". That is, they were able to form and recall stored images - to symbolise - but were unable to manipulate or generalise from these images. However, as mentioned above, this study confounded imitation and symbolic, or pretend, play skills, and the results could be interpreted as being relevant to the problems with pretend play shown by children with autism, and not imitation deficits per se. A similar explanation was advanced by Sigman and Ungerer (1984b) to account for their results in a study which investigated the relationships between sensorimotor development and symbolic development (symbolic play, imitation and language development). Sigman and Ungerer (1984b) concluded that a defining characteristic of autism is significantly more proficient sensorimotor capacities than symbolic and imitative skills. They suggest that representational thought may be manifested in two separate systems. One, reflected in the development of sensorimotor

skills, involves the capacity to recall information that is then accessible for problem-solving. The capacity to manipulate such symbols is required to translate experience into language and play signals, and it is this second symbolic system which is specifically impaired in autism. Morgan et al. (1989) outline a similar hypothesis, arguing that Piaget's (1967) "two-factor" theory of sensorimotor development is relevant. In autism the basic representation system (which deals with the *figurative* aspects of symbols) is intact, whilst the conceptualisation system (which deals with the *operative* aspects of symbols) is impaired.

Jones and Prior (1985) take a more neurodevelopmental perspective. They build on DeMyer et al.'s (1972) earlier suggestion that imitation deficits in autism might be due to poor visual memory, a defective body image, or both; and claim that autistic children are literally unable to coordinate their limbs due to inadequate neuromotor development. They link this with other "soft signs" of neurological damage which were identified in their sample of children with autism. In another recent neurodevelopmental account, Rogers and McEvoy (1993) found that difficulties shown by subjects with autism in imitating other person's body movements were independent of verbal imitation abilities, and were not explained by memory or motor problems. In this experiment, impaired imitation was significantly related to impaired performance on executive functioning tasks (Tower of Hanoi, Wisconsin Card Sorting Test) in the subjects with autism. Rogers and McEvoy conclude that difficulties in both the body imitation (but not facial imitation tasks on which performance was intact) and executive functioning tasks can be explained by a difficulty in the process by which representations of a movement are formed and maintained in working

memory while they guide motor actions.

However, as indicated above, the explanation for autism-specific impairments in imitation which has attracted most support, and which has developed into a precursor of theory of mind hypothesis, is that put forward by Meltzoff and his colleagues (Meltzoff, 1990; Meltzoff and Gopnik, 1993; Meltzoff and Moore, 1983, 1989, 1992), and elaborated by Rogers and Pennington (1991).

6.3.2 Imitation as a precursor to a theory of mind

Meltzoff (1990) suggests that the three aspects of imitation - social mirroring, social modelling and self practice - provide an important foundation for the development of self, and a means by which we can catch a glimpse of the earliest workings of the self in the preverbal child. Meltzoff and Moore (1983, 1989, 1992) proposed that neonatal imitation provides evidence of an underlying ability to recognise and use the equivalences between body movements they see and body transformations of their own that they proprioceptively "feel" themselves make. One possible mechanism to explain this ability is that infants can represent human movements patterns they see and ones they perform using the same internal code, which must be non-modality-specific. Meltzoff and Gopnik (1993) make the claim that both internal proprioceptive sensations and motor intentions may be half-way stations between behaviour on the one hand, and mental states on the other. That is, that infants' understanding of bodily movements are the bedrock for "like me" judgements, and that this in turn is connected to the ascription of "like me" human minds. Meltzoff and Gopnik (1993)

summarise the relevance of early imitation to the later development of a theory of mind: "it provides the first, primordial instance of infants making a connection between the visible world of others and the infant's own internal states" (p. 337).

In addition, they suggest that children with autism may fail to develop imitation because of an impairment in their capacity for recognising the cross-modal correspondences between their own movements and the movements of others. They argue that a disturbance in this early developing, hard-wired, ability would have serious consequences for a child's social-communicative development, and specifically for the development of their theory of mind.

Rogers and Pennington (1991) have developed a similar hypothesis, emphasizing the important role of imitation in the development of social reciprocity and intersubjectivity (Stern, 1985), affective sharing (Malatesta and Izard, 1984), and social learning (Bruner, 1975). They utilise Stern's (1985) interpersonal theory of development, which views subjective knowledge of self and other as starting with the *physical self*, shared through imitation, moving to the *affective self*, shared through mutual emotional exchanges, then to the *intersubjective self*, shared through a theory of interfacing minds and related developments in communication and shared understandings. In Rogers and Pennington's (1991) developmental model - in which they suggest that a "cascade" effect operates, whereby lack of certain aspects of interpersonal development at every previous stage disrupts certain developments in the following stage - imitation, emotion sharing and theory of mind are increasingly complex expressions of the basic ability to form and coordinate representations of self

and other, and to use those representations to guide the planning and execution of one's own behaviour. They propose that in autism deficits in early development of the coordination of self-other representations occur at each of the levels which Stern delineates. In a recent review, Tomasello et al. (1993) ascribe an important role to imitation in social development, and what they term "cultural learning", a thesis which is similar to that developed by Rogers and Pennington (1991), and especially Meltzoff and Gopnik (1993).

Rogers and Pennington (1991) and Charman and Baron-Cohen (1994a) address several criticisms of the imitation-as-precursor thesis. They argue that the characteristic autistic phenomenon of echolalia, and the successful use of imitation in teaching programmes for children with autism, undermine the thesis. In short, imitation deficits in autism may not be universal or lifelong.

The notion that imitation may be a developmental "precursor" of a theory of mind is not only important for theoretical reasons, but also opens the possibility that deficits in neonatal imitation ability may allow autism to be detected at a younger age than is presently possible. This would be important clinically, since currently the earliest predictors of autism are deficits in both pretend play and joint attention at 18 months of age (Baron-Cohen et al., 1992).

6.4 EXPERIMENT 4

6.4.1 Procedural imitation task

Method

The materials and method for the procedural imitation task followed those described by Meltzoff (1988a,b), and employed with older autistic subjects by Charman and Baron-Cohen (1994a). The child sat opposite the experimenter. Four imitative acts and objects were employed, all designed to be unfamiliar to the child:

1. *Dumbbell*. The first object was a dumbbell-shaped toy that could be pulled apart and put back together again. The action demonstrated was to pick up the object by the wooden cubes and to pull outwards so the toy came apart, and then to put the two pieces back together.
2. *Hinge*. The second was an L-shaped hinge made of a flat rectangular base and a wooden flap that could be folded flat or to an angle of 135 degrees. The action demonstrated was to unfold the flap to its maximum angle and to return it to the flat position.
3. *Beeper*. The third object was a small black box, with a recessed button on the top surface. The box was tilted by a support so that the top surface was facing the subject. The action demonstrated was to push in the recessed button, which

produced a mechanical beeping sound.

4. *Light box.* The fourth object was another small black box, with a translucent panel on its top surface. The novel action demonstrated was for the experimenter to lean forward and touch the top panel of box with his forehead, which illuminated the top panel of the box.

Each action was performed 3 times in a 20 second period. At the end of the four modelling periods (about 2 minutes in all), the children were given a sequence of four response periods of 20 seconds. The object was handed towards the child and placed in front of them. One non-specific prompt ("What can you do with this?") was given if the child failed to pick up or manipulate the object at once.

Scoring

The following scoring criteria were adopted:

1. *Dumbbells:* To pass, the subject had to pick up the dumbbells by the wooden cubes and pull these outwards so that the toy came apart, and make some attempt (even if unsuccessful) to put tubes back together again. If the subject picked up only one end of dumbbells and they fell apart, or twisted them "head over heels", a fail was scored.
2. *Hinge:* To pass, the flap had to be pushed up by an angle of at least 45

degrees. If the whole hinge array was picked up and manipulated in any other way, a fail was scored.

3. *Beeper*: To pass, the subject had to make a deliberate and successful attempt to activate the beeper by pushing on the recessed button. If the whole box was picked up and manipulated in any other way (even if this resulted in the button being pushed in the process) a fail was scored.
4. *Light box*: To pass, the subject had to illuminate the box by touching their nose/face/head to the surface of the box. If the box was picked up and manipulated in any other way (even if this resulted in the light being illuminated in the process) a fail was scored.

Inter-rater reliability

48 trials were rated by a second rater across for presence or absence of imitation, across the 4 tasks. Measured in percentage terms the mean agreement was 98% (range 94% to 100%), and as measured by kappa 0.96 (range 0.85 to 1.00).

6.5 RESULTS

The proportion of completed imitation trials on which subjects successfully imitated the modelled action, according to the above criteria, are shown in Table 6.1. The mean number of trials completed by subjects in each group are also shown in Table 6.1. Not

all subjects completed all four trials due to non-cooperation, and one child in the normal group did not take part in the imitation task due to an administrative error. However, there was no significant difference between the mean number of trials completed by each group (ANOVA, $F(2,44) = 1.80$, $p = ns$). The data was analyzed by ANCOVA, with CA, NVMA and LA entered as covariates. There was no significant group effect (ANCOVA, $F(2,40) = 1.50$, $p = ns$), but there was a significant covariate effect for NVMA, with children with a higher NVMA showing more imitation than younger children (ANCOVA, $F(1,40) = 2.43$, $p < 0.02$).

In addition, "reliable" and "unreliable" imitation performance by children across all three groups was identified, using the cut-off of successful imitation in at least 75% of completed trials previously employed by Charman and Baron-Cohen (1994a). The percentage of children in each group who reliably imitated is shown in Table 6.2. Non-parametric analysis demonstrated that significantly more children in the normal group reliably imitated than in the autism group. The performance of the developmental delay group was between that of the normal and autism groups, but was not statistically different from either. ($X^2 = 15.4$, $p < 0.001$; Fisher's exact: A x DD = ns; N x DD = ns; A x N $p < 0.001$). Post-hoc comparisons comparing the mean CA, NVMA, and LA of the children in each group who imitated in greater, or fewer, than 75% of completed trials were conducted. Due to the multiple comparisons this involved, a conservative level of significance of $p < 0.01$ was adopted, in order to minimise the risk of false positive, or Type I, errors. None of the analyses reached significance.

Table 6.1 Proportion of trials on which imitation occurred by diagnostic group

	n	Imitation x (sd)	Mean number of completed trials x (sd)
Autism	13	0.38 (0.37)	3.92 (0.28)
Developmental delay	18	0.58 (0.31)	3.72 (0.67)
Normal	16	0.78 (0.20)*	4.00 (-)

ANCOVA

Main effect of GROUP $F(2,40) = 1.50$ $p = ns$
Covariate effect: NVMA $F(1,40) = 2.43$ $p < 0.02$

Table 6.2 Percentage of each group who imitated in at least 75% of completed trials.

	n	Imitation
Autism	13	15.4%
Developmental delay	18	44.4%
Normal	16	87.5%*

* $X^2 = 15.4$ $p < 0.001$ [Fisher's exact: A x DD = ns; A x NN =ns; A x N $p < 0.001$]

6.6 DISCUSSION

The imitation tasks did not produce an autism-specific impairment. The multivariate analysis found no group differences on the overall proportion of trials on which imitation occurs. The nonparametric analysis found that subjects with autism imitated less reliably than the normal children, but not the developmentally delayed children. Thus, across both analyses used the performance of children with autism did not differ from that of the developmental delay controls. The significant covariate effect for NVMA showed that across all groups children with a higher NVMA produced more imitation, which may explain the more reliable performance of the normal controls, 15 out of 17 of whom were reliable imitators (imitating on at least three-quarters of completed trials).

6.6.1 Comparison to previous studies

Although the present results contradict many of the previous findings, reviewed above, that imitation is impaired in autism (Curcio, 1978; Dawson and Adams, 1984; DeMyer et al., 1972; Hertzog et al., 1989; Jones and Prior, 1985; Ohta, 1987; Sigman and Ungerer, 1984b), they are consistent with the studies that have found intact imitation ability in autism (Charman and Baron-Cohen, 1994a; Loveland et al., 1994; Morgan et al., 1989; Thatcher, 1977). Indeed a direct comparison is possible with Charman and Baron-Cohen (1994a), who employed the same tasks with school-aged children with autism. Whilst their older sample (CA = 140 months, VMA = 46 months, NVMA = 85 months) were at ceiling on the procedural imitation tasks, imitating on 87.5% of

the trials, the present much younger and less able subjects with autism imitated on only one third of trials. Morgan et al. (1989) suggest that the higher MA of their sample, compared to some of the previous samples employed, explains their positive finding. However, the present study which employed a control group matched for MA, and covaried for the effects of CA and MA in the analysis, suggests that even younger children with autism have some intact imitation ability. Other studies have demonstrated intact ability to imitate familiar, learnt routine gestures (Dawson and Adams, 1984; Rogers and McEvoy, 1993), as well as a basic intact ability in the more developmentally complex process of social mirroring (Dawson and Adams, 1984). In addition, the use of motor imitation as a learning tool is widespread in intervention programmes (Charman and Baron-Cohen, 1994a).

How do the present results compare with work with normally-developing children? The tasks employed were based on Meltzoff's (1988a) study with 9-month-old children. Meltzoff's (1988a) presentation of his data does not allow for a simple comparison, but in his imitation condition 50% of his sample produced 2 or 3 imitative acts from three trials. This compares to 15%, 44% and 88% of the children with autism, developmentally-delayed children and normal children, respectively, who met the present more stringent criteria for reliable imitation of imitating on at least three out of four trials. Thus, whilst this comparison suggests that the children with autism appear to show some delay compared to normally-developing infants, the impairment is not gross, nor was it found to be autism-specific.

6.6.2 Relation to theoretical accounts of imitation as a precursor

Both Rogers and Pennington (1991), and Meltzoff and Gopnik (1993), have proposed that imitation is a precursor to the development of a theory of mind. In doing so they emphasise the importance of imitation as a form of social communication, or social interaction, which develops early on infancy, or possibly even earlier in the neonatal period (Meltzoff, 1988a; Meltzoff and Moore, 1992). They argue that imitation is therefore a hard-wired innate ability which is a crucial bedrock for all later social communication abilities and propensities. The present results, along with other demonstrations of intact imitation in school-age children with autism (Charman and Baron-Cohen, 1994a; Morgan et al., 1989), suggest that a strong version of the imitation-as-precursor hypothesis must be ruled out. It appears that even some 20-month-old children with autism are capable of recognising the cross-modal correspondences between their own movements and the movements of others that Meltzoff and Gopnik (1993) state are disrupted in autism. Some imitation ability is present in 20-month-olds with autism, and ability to imitate the simple actions involved in the Meltzoff tasks is intact by middle childhood. Whilst, there is some experimental evidence for delayed development of imitation in autism, the delays are not consistently autism specific, nor are they severe, nor pervasive. However, in order to *disprove* the hypothesis that imitation is a precursor to a theory of mind it would be necessary to document individuals who have an intact theory of mind in the presence of impaired imitation. The present study does not do this, and we know of no relevant data from elsewhere. However, at present, the potential for deficits in neonatal imitation aiding in the very early detection of autism, before other autism-

specific deficits such as joint attention and play emerge, does not have empirical support.

A recent study by Rogers and McEvoy (1993), suggests a way forward for piecing these contradictory findings together. They found specific deficits in high functioning children and young adults with autism in *practic* abilities - the capacity for planning and carrying out intentional motor movements - and in executive functioning abilities (and in addition a strong relationship between performance on the two tasks), but no impairment in their ability to imitate single meaningful facial and hand-and-arms movements, or gestures. Rogers and McEvoy (1993) interpret their results as showing that familiar, learnt gestures can be imitated, but not more complex, unfamiliar gestures. However, the study confounds the effects of familiarity, with the sequential and *practic* complexity of the gestures employed. Several recent studies have demonstrated impaired executive functioning ability, even in older, high- functioning children and young adults with autism (Hughes and Russell, 1993; Hughes et al., 1994; McEvoy et al., 1993; Ozonoff et al., 1991; see Bishop, 1993; for a review). Studies which have demonstrated specific impairments in imitation in autism may be confounding these *practic* and executive deficits, with a "pure" imitation deficit. The simplicity of the Meltzoff tasks employed in the present research, and by Charman and Baron-Cohen (1994a), overcomes this confound and demonstrates the relative intact development of imitation in autism.

Another difference between the present research and much of the previous experimental work on imitation in autism is the use of procedural, rather than gestural,

imitation. Whilst Charman and Baron-Cohen (1994a) did not find significant differences between the performance of their school-age sample of children with autism on procedural or gestural tasks, previous findings with children with autism (DeMyer et al., 1972) and normally-developing children (Meltzoff, 1988b; Uzgiris and Hunt, 1975) suggest that development of gestural imitation may lag behind that of procedural imitation. Whether this suggests that the two forms of imitation may depend on different underlying cognitive competencies is unclear, and has yet to be tested. It may be that the greater "social-embeddedness" of gestural imitation tasks means that it is gestural, rather than procedural, imitation which acts as a precursor to the later development of a theory of mind (see Tomasello et al., 1993). The present research does not provide a contrast between gestural and procedural imitation in the 20-month-old children with autism studied. However, as reviewed above, there is some evidence for intact gestural imitation in older children with autism - at least for gestures that involve simple, single movement gestures (Charman and Baron-Cohen, 1994a; Loveland et al., 1994; Morgan et al., 1989; Rogers and McEvoy, 1993). Therefore these previous findings for gestural imitation in autism, alongside the present findings for some intact procedural imitation in autism, do not support a strong imitation-as-precursor thesis.

CHAPTER SEVEN:

COMPARING RESULTS ACROSS TASKS

Method

In order to compare results across the experimental tasks, and to do so in a parsimonious fashion, avoiding multiple comparisons between the variables measured on each of the tasks, one key measure was chosen from each task. These key variables were chosen using two criteria: First, they had to embody the key nature of each of the precursor abilities measured; and secondly, they had to have provided the most clear separation between the groups. Thus, it would be possible to compare the relationships between the precursor abilities in both normal and abnormal development.

Three methods of comparing group performance across tasks were employed. First, within-group correlations were calculated. Second, a multivariate statistical technique (discriminant function analysis) was used to identify which key variables best discriminated between the autism and developmentally delayed groups was conducted. Third, a more clinically-relevant non-parametric analysis to establish whether, against predetermined criteria, cognitive or affective tasks best identified the children with autism from the developmentally delayed and normal children was carried out. These analyses are now presented in turn.

7.1 CORRELATIONS BETWEEN TASK PERFORMANCE WITHIN GROUPS

Correlations within each group between one key index of task performance in each area investigated, and measures of CA, NVMA and LA, were conducted to compare the relationships between the proposed precursor abilities, and between the precursors and measures of developmental maturity. The measures chosen to represent task performance of key abilities within each domain were:

- * **Pretend play:** The production of pretend play in spontaneous/free play task (see Section 4.5.2).
- * **Joint attention:** The percentage of completed trials on which the child looked to either adult (caregiver or experimenter) (see Section 5.5.1).
- * **Imitation:** The percentage of completed trials on which the modelled action was imitated (see Section 6.5).
- * **Empathy:** Showing facial concern in response to experimenter "distress" (see Section 3.5.1).
- * **Attachment:** Looking to mother on reunion (see Section 3.5.2).

Correlations were conducted so that subjects who had missing data for any of the variables entered into the correlation analysis were excluded from the analysis. Such a conservative methodology minimises the likelihood of obtaining inflated correlation coefficients due to the statistical manipulations employed in missing-value-included options of the statistical programme employed (SPSS/PC+). Thus, for each group, the subjects entered in the correlation analysis had valid scores for each measure. The

number of subjects entered in the correlation analysis were 12, 14 and 13, for the autism, developmental delay and normal groups, respectively. The correlation matrices for each group are shown in Tables 7.1 to 7.3.

There was only one significant correlation between performance on the experimental tasks across all three groups. In the autism group the key empathy measure (showing facial concern) was significantly correlated with the proportion of joint attention trials on which the children looked to either adult (0.82, $p < 0.001$; see Table 7.1). However, this reflects the performance of one child only, who both showed facial concern in the empathy task and was also the only child to look to either adult on 100% of joint attention trials. Indeed, in the autism group relatively few children produced any of the key behavioural measures used in the correlational analysis (with the exception of imitation), and thus the co-incidence of two positive measures for one subject can inflate the between task correlations within such a small group. In addition, looking to either adult on the joint attention trials was significantly correlated to LA for the autism group (0.81).

This confirms the previous findings of Mundy et al. (1990), and may indicate that in autism, as well as in normal development, joint attention behaviours form the basis for the development of spoken language (Bates, 1979; Bruner, 1983; see Section 5.1). There was one significant correlation for the developmental delay group. Although the finding that performance on the imitation tasks correlates with NVMA (0.69, see Table 7.2) is relatively trivial, it confirms previous findings (Charman and Baron-Cohen, 1994a). There were no significant correlations for the normal group.

Table 7.1 Correlations between task performance for the autism group (n = 12).

	CA	NVMA	LA	PRETEND PLAY	JOINT ATTENTION	IMITATION	EMPATHY	ATTACHMENT
CA	1.00	-	-	-	-	-	-	-
NVMA	0.41	1.00	-	-	-	-	-	-
LA	-0.56	-0.31	1.00	-	-	-	-	-
PRETEND PLAY	#	#	1.00	-	-	-	-	-
JOINT ATTENTION	-0.28	0.47	0.81**	#	1.00	-	-	-
IMITATION	-0.03	0.32	0.36	#	0.53	1.00	-	-
EMPATHY	-0.11	0.18	0.59	#	0.82**	0.52	1.00	-
ATTACHM.	-0.59	-0.18	0.24	#	-0.02	0.16	-0.13	1.00

* p < 0.01

** p < 0.001

correlation coefficient cannot be calculated due to lack of variance [all 12 subjects failed to produce spontaneous pretend play]

Table 7.2 Correlations between task performance for the developmental delay group (n = 14).

	CA	NVMA	LA	PRETEND PLAY	JOINT ATTENTION	IMITATION	EMPATHY	ATTACHMENT
CA	1.00	-	-	-	-	-	-	-
NVMA	-0.21	1.00	-	-	-	-	-	-
LA	-0.09	0.12	1.00	-	-	-	-	-
PRETEND PLAY	-0.32	0.11	-0.13	1.00	-	-	-	-
JOINT ATTENTION	-0.03	0.20	-0.14	0.03	1.00	-	-	-
IMITATION	-0.11	0.69*	-0.07	0.25	0.47	1.00	-	-
EMPATHY	-0.55	0.06	0.33	0.07	0.03	-0.15	1.00	-
ATTACHM.	0.48	0.12	-0.27	0.03	0.20	0.04	-0.34	1.00

* p < 0.01
** p < 0.001

Table 7.3 Correlations between task performance for the normal group (n = 13).

	CA	NVMA	LA	PRETEND PLAY	JOINT ATTENTION	IMITATION	EMPATHY	ATTACHMENT
CA	1.00	-	-	-	-	-	-	-
NVMA	0.20	1.00	-	-	-	-	-	-
LA	-0.48	0.55	1.00	-	-	-	-	-
PRETEND PLAY	-0.12	0.14	0.58	1.00	-	-	-	-
JOINT ATTENTION	0.09	0.54	0.18	0.27	1.00	-	-	-
IMITATION	0.19	-0.02	-0.28	-0.03	-0.02	1.00	-	-
EMPATHY	-0.15	0.42	0.54	0.35	0.27	-0.03	1.00	-
ATTACHM.	#	#	#	#	#	#	#	1.00

* p < 0.01

** p < 0.001

correlation coefficient cannot be calculated due to lack of variance [all 13 subjects looked to mother on reunion]

How should the fact that relatively few correlations were found overall be interpreted? The lack of significant correlations, including only two between task performance and the developmental maturity indicators (CA, NVMA, and LA), may be accounted for by the relatively small group sizes, and the small range of CA, NVMA and LA within each group. Other studies which have found significant relationships between task performance and CA and MA measures (e.g. Baron-Cohen, 1987; Mundy et al., 1990; Yirmiya et al., 1992) have employed older subject samples, which have had a considerably greater spread of age and ability, than in the present study.

The fact that performance on the different tasks were not generally highly correlated suggests that the potential criticism raised in Section 3.6.1, that the experimental measures may confound one another, is unlikely to be valid. For example, measures such as the child looking at mother on reunion of the attachment task, are not highly correlated with looking behaviour on the joint attention tasks. The tasks do appear to be measuring differentiable aspects of social-communication behaviour in infancy that specifically relate to the different situations that the experimental manipulations and procedures created. Thus, the relative absence of correlations provides some construct validity for the experimental measures as truly separable measures of potential precursors of a theory of mind, which are dissociable aspects of infantile social-communicative development.

7.2 A DISCRIMINANT FUNCTION ANALYSIS TO SEPARATE THE AUTISM AND DEVELOPMENTAL DELAY GROUPS

A statistical method of examining how well the performance of any individual on the candidate precursor measures predicts which group the individual was drawn from is to conduct a discriminant function analysis using key index experimental measures from each task, as well as CA, NVMA and LA measures. This analysis is a multivariate statistical method for determining the unique variance contribution of each variable to the overall group classification. This analysis will only be carried out between the autism and the developmental delay groups, for two reasons. First, the normal group is not matched to the two clinical groups on NVMA or LA, so that NVMA and LA are likely to strongly predict membership of the normal group. In addition, the most clinically-relevant separation is that between the group with autism and the NVMA- and LA-matched developmental delay group. Further, a discriminant analysis involving three groups is not only more complex to conduct, but critically it is more difficult to interpret confidently. Although the analysis calculates two discriminant functions which orthogonally separate the three sets of groups out best, it is not necessarily the case that the two canonical functions provide simple between-group comparisons. For example, it is not always the case that (say) function 1 separates group 1 from group 2 and 3, and function 2 separates groups 1 and 2 from group 3. Hence, there are statistical as well as clinical reasons for entering only the autism and developmental delay subjects in a discriminant analysis, to determine which of the precursor variables (as well as measures of developmental maturity) best separately categorises those children with autism from those children with

developmental delay but without autism.

The same variables entered into the above correlational analysis (Section 7.1) were entered into a Wilks-method discriminant analysis, employing a minimum F-to-enter and F-to-remove of 1.0. The results are shown in Table 7.4. Thus, 3 descriptive and 5 experimental variables were entered as predictors of membership of the autism and developmental delay groups. The discriminant function significantly discriminated between the groups ($X^2 = 31.0$, $p < 0.001$). Two variables made significant contributions to the classification - look to adult on the joint attention task and look to mother on reunion on the attachment task. Performance on the joint attention task was entered first (F-to-enter = 50.3, Wilks Lambda = 0.92), performance on the attachment task was entered second (F-to-enter = 1.1, Wilks Lambda = 0.34). None of the other measures made a significant positive independent contribution to the classification of children into either the autism or developmental delay group. Performance on the joint attention task alone correctly classified 90% of the sample, and with performance on the attachment task included 94% of the sample were correctly classified.

The interpretation of a discriminant function analysis should be conducted with caution, in particular since the present analysis included several characteristics that weaken the robustness of the approach: small sample sizes, the use of discrete rather than continuous variables, and violations of the multivariate assumptions of normality of distribution and homogeneity of variance. Notwithstanding these notes of caution, joint attention emerged as by far the strongest discriminating variable between the

autism and development delay groups. The next best predictor, although considerably weaker, was the attachment task measure of look to mother on reunion. Once again, caution is warranted in the interpretation of this finding, since Experiment 3 demonstrated that whilst "looking behaviour" attachment measures may be impaired in autism, other measures of attachment behaviour, such as distress on separation and proximity seeking on reunion, may be unimpaired (see Section 3.6.2). Taken together, these results therefore provide support for the theories reviewed above (see Chapter 5) which posit joint attention as a precursor to the development of a theory of mind (Baron-Cohen, 1994). In addition, they also provide some support, albeit weaker, for the theories reviewed above (see Chapter 3) which argue that affective measures are also crucial (Charman, 1994b; Hobson, 1993a,b; Mundy et al., 1993).

Table 7.4 Discriminant analysis between autism and developmental delay group

The overall discriminant function significantly separated the groups:
 $X^2 = 31.0$, $p < 0.001$

Step 1 Joint attention was entered.

F-to-enter = 50.3 Wilks Lambda = 0.92

Following Step 1 90.3% of cases were correctly classified.

Step 2 Attachment was entered.

F-to-enter = 1.1 Wilks Lambda = 0.34

Following Step 2 93.6% of cases were correctly classified.

No other variables significantly contributed to the classification of subjects into the groups.

The pooled-within-groups correlations between the *discriminating variables* and the discriminant function were:

Joint attention	0.97
Imitation	0.40
LA	0.23
NVMA	0.22
Attachment	0.20
Pretend play	0.18
Empathy	0.11
CA	0.04

Classification matrix:

Actual group	n	Predicted group membership	
		Autism	Developmental
delay			
Autism	13	12	1
Developmental delay	18	1	17

93.6% of cases were correctly classified.

7.3 SEPARATING THE AUTISM GROUP USING PRESET CRITERIA

One question of clinical importance which the present data can be used to address is how well does the performance on the various tasks separate the groups from one another, and in particular how well children with autism can be identified separately from the developmental delay and normal children from their task performance? This is of importance for any future developments which would use task performance on similar tasks as part of a screening exercise, either within the general population (Baron-Cohen et al., 1992; 1994), or within clinic populations (Baron-Cohen and Howlin, 1993).

For experimental tasks to have clinical utility, simple criteria, or thresholds, have to be employed, above which a child tested on the battery of tasks is considered at high risk or likelihood of having the identified disorder. Clinical assessment tools commonly work by either providing a scale score which is measured against a preset cut-off, or the presence or absence of key behaviours are identified by some algorithm to indicate the presence or absence of the relevant pathology. The present tasks most simply lend themselves to the latter method. The performance of the children on the key measures of the precursor abilities utilised in this chapter can be used to attempt to separate the groups, and identify the children with autism from the controls. The results of such analyses will be presented in three ways:

Trial 1 The ability of the 2 *cognitive* measures on which there were autism specific impairments - pretend play and joint attention - to separate the groups (cf. the use of the CHAT as a whole population screening

instrument, Baron-Cohen et al., 1992; 1994; and see Chapter 2).

Trial 2 The ability of the 2 *affective* measures on which there were autism specific impairments - empathy and looking behaviour in the attachment paradigm - to separate the groups.

Trial 3 The ability of all 4 measures (*cognitive and affective*) combined to separate the groups.

Thus, the task on which no *autism-specific* impairments were found - imitation - has been excluded from these analyses, as it was unlikely to contribute to the clinically-desirable separation - that of the autism group from the other two groups. In order to carry out such analyses cut-off points had to be set for performance on each task. For some tasks this is simple, since the measure taken is that of either the presence or absence of an index behaviour in a one trial experiment (e.g. showing facial concern in the empathy task). In other tasks the cut-offs previously used to compare performance across all the trials were employed (e.g. looking to an adult on at least one joint attention trial). For each experiment the index measure chosen was that that had best separated the groups in that experiment and that best captured the exclusive aspect of the precursor ability being measured. The cut-offs employed were:

- * **Pretend play:** The production of pretend play on the spontaneous/free play task.
- * **Joint attention:** Looking to adult on at least one joint attention trial.

- * **Empathy:** Showing facial concern on single empathy trial.
- * **Attachment:** Looking to mother on reunion in single separation-reunion trial.

The data relevant to the 3 attempts, or trials, to separate the groups on the basis of their task performance are shown in Table 7.5. Similar to the correlations presented above, this comparison does not allow for missing data on any of the variables being concerned, and the total number of subjects entered for each group on each separate comparison are shown in Table 7.5.

For the pairs of cognitive and affective measures (Trials 1 and 2) the algorithm employed was failing both tasks. For the trial with all four measures (cognitive and affective) (Trial 3) an algorithm of passing one or fewer of the tasks was employed. The power of the sets of measures to achieve separation between the groups, in particular to identify the children with autism from the controls, can be measured in two ways: in terms of their *specificity* (the proportion of those identified by the algorithm who actually are autistic) and their *sensitivity* (the proportion of the children with autism who are identified by the algorithm). Comparing the two sets of measures produced the following results:

Cognitive measures - Children who fail both pretend play and joint attention tasks according to the above criteria, or cut off: Specificity = 100%; Sensitivity = 62%.

Affective measures - Children who fail both empathy and attachment tasks according to the above criteria, or cut off: Specificity = 90%; Sensitivity = 75%.

Table 7.5 Separating the groups according to performance on the index measures for each precursor task

<hr/>			
<u>Trial 1</u>	<u>Pretend play and Joint attention</u>		
	Autism	Developmental delay	Normal
Pass None	8	-	-
Pass One	5	10	6
Pass Both	-	7	10
n	13	17	16
<u>Trial 2</u>	<u>Affective measures - Empathy and Attachment</u>		
	Autism	Developmental delay	Normal
Pass None	9	1	-
Pass One	3	10	7
Pass Both	-	3	8
n	12	14	15
<u>Trial 3</u>	<u>All 4 measures Pretend play, Joint attention, Empathy and Attachment</u>		
	Autism	Developmental delay	Normal
Pass None	7	-	-
Pass One	3	1	-
Pass Two	2	6	3
Pass Three	-	6	5
Pass Four	-	1	6
n	12	14	14
<hr/>			

All 4 measures (Cognitive and Affective) - Children who pass one or fewer tasks according to the above criteria: Specificity = 91%; Sensitivity = 83%.

For clinical purposes, such as the adoption of tests as part of a screening or diagnostic battery, it is not a problem having a specificity below 100% as long as it is fairly high, since all of the index children will be seen, and in addition a few other children who do not have the index problem, but may have other clinical or sub-clinical problems, will also be seen. What is more problematic is to have a low sensitivity, since cases are missed and not identified by the screen. From the present sample, although all 8 children with autism were identified correctly by the cognitive pair of measures, and no children from the other groups falsely identified (specificity = 100%), 5 of the 13 children with autism were missed (sensitivity = 62%). Using the affective pair of measures, 10 children would have been identified, only 9 of whom actually were autistic, along with 1 child with cognitive or language delay (specificity = 90%). In addition 9 of the 12 children with autism were identified, with 3 being missed (sensitivity = 75%). When all four measures were considered and the cut-off employed was passing one or none tasks only 1 child with developmental delay was incorrectly identified (specificity = 91%), and 2 of the 12 children with autism were not picked up (sensitivity = 83%).

Several interesting findings emerge from this analysis. First, good separation is achieved by both the use of the pair of cognitive (joint attention and pretend play) variables and by the use of the pair of affective (empathy and attachment) variables. In addition, although including both cognitive and affective measures increases the

complexity, since more combinations of passing and failing are possible, employing both cognitive and affective measures produced the best identification of the children with autism, with a specificity and sensitivity well within established acceptable limits for assessment tools employed in other areas of child psychiatry (Fundudis et al., 1991; Le Couteur et al., 1989; Lord et al., in press).

A further point of interest is in the pattern of passing and failing in those children who passed one, but not the other, of the key items in both the cognitive pair, and in the affective pair. Across all three groups 21 children failed to reach the preset criteria on only one of the two cognitive tasks: pretend play and joint attention. In all but one case (a child with autism) the failed item was pretend play. Therefore, it appears that in normal development at least joint attention is intact before play develops. The one child with autism who had the reverse pattern may well be demonstrating a deviant pattern of development (Baron-Cohen, 1991a). The fact that joint attention may itself be a precursor for the development of pretend play, and thus of the development of a theory of mind (Baron-Cohen, 1994), receives some support from this pattern of results, and will be discussed in more detail in Chapter 8. For the affective pair of measures no clear pattern emerged amongst those who failed only one of the two items, as to which was more likely to be failed across all three groups.

The next chapter will summarise the results of Experiments 1 - 4, and well as the across-task analysis, and reconsider the status of the candidate precursors.

CHAPTER EIGHT:

GENERAL DISCUSSION AND CONCLUSIONS

Two sets of questions arise from the present research: (1) theoretical questions about the precursor status of the candidate precursors to a theory of mind, and (2) clinical questions about the potential for a better understanding of precursors of theory of mind abilities, and their impairment in infants with autism, to aid early identification of children with autism. Each will be considered in turn.

8.1 THE RESEARCH DESIGN

Although no direct measure of theory of mind ability was taken, and thus performance on the precursor tasks cannot be directly related to theory of mind competence, the present cross-sectional experimental design affords us two methods of assessing the claims of the candidate precursors. First, we know that the majority of older children with autism either completely lack a theory of mind, or its development is significantly delayed (see Baron-Cohen, 1993; Happe, 1994a; for reviews). Hence, we would expect the majority of these 20-month-old children with autism to show significant delays in the development of precursors to a theory of mind. On the other hand, intact development of any of the candidate precursor abilities would considerably weaken their claim to be a precursor to the development of a theory of mind. Second, if children with developmental delay, but without autism, are impaired

in any of the candidate precursor abilities, then the candidate precursor may be developmentally related to general developmental delay, rather than autism-specific impairments which later manifest themselves as a delayed or absent theory of mind.

A more direct test of the precursor status of the candidate precursors, and of the developmental relationships between the precursor abilities, will be forthcoming when the present sample are followed up at age 42 months. Then, direct measures of theory of mind competence at age 42 months can be related to the present data on precursor abilities at 20 months. However, the present thesis has to rely on the quasi-experimental design set out above.

8.2 A BRIEF SUMMARY OF RESULTS

8.2.1 Affect responsivity

The empathy task demonstrated autism-specific impairments in two measures of empathic response - looking to the experimenter's face and expressing facial concern - and showed a trend towards children with autism producing less social referencing - stopping playing with the toy following the experimenter's distress. However, on the control measure which assessed looks to the experimenter's hand - designed to measure an instrumental response to the incident - there were no group differences. Hence, there is no indication that the children with autism looked less overall, rather that they specifically produced less social looks.

The single-episode, separation-reunion attachment paradigm produced mixed results, with the children with autism producing less of some attachment behaviours (noticing mother's departure (compared to normal children only) and looking to mother on reunion (compared to both control groups)), and no group differences on others (distress on separation, touch mother and proximity-seeking on reunion). However, the abnormality on looking behaviour may reflect some other process (e.g. face processing, or attentional measures). Overall, attachment behaviours were found to be relatively intact in the sample of children with autism. However, whilst these specific attachment behaviours can be seen as the demonstrable building-blocks of an attachment relationship, they do not constitute a measure of security of attachment.

8.2.2 Pretend play

There was only one clear difference between the groups on the spontaneous play task: less children with autism produced pretend play than developmentally delayed or normal children. In the structured play tasks, children with autism produced less functional play acts than the control groups, and less object substitutions (intended, using Leslie's (1987) definition of pretence, to be examples of simple pretend acts). Although the spontaneous and structured play tasks cannot be directly compared, since they employ different play materials, there was no facilitation in the production of pretend play acts under elicited conditions compared to under spontaneous conditions. Indeed, although children with autism were intact on the production of functional play in the spontaneous play task, they were specifically impaired compared to the control groups on the two structured play functional trials.

8.2.3 Joint attention

The children with autism showed specific impairments in the amount of joint attention behaviour produced. However, there were no group differences on the measure of looking to the box that controlled the toys. This was intended to be a control measure of instrumental looking - since most children seemed to be aware that the box controlled the toys and looked when the toy was stopped and restarted during the one minute sequence of stops and starts. In sum, there was no evidence that children with autism were looking less overall - merely that they produced less social and communicative looks. On the other behaviours measured - pointing, reaching, and vocalising - group differences were less clear. Whilst there were no differences on the proportion of trials on which these behaviours occurred, and indeed the incidence of pointing and reaching was low overall, when measured in terms of production of the key behaviours on at least one trial group differences did emerge. Only one child with autism pointed, against one quarter of the developmental delay controls and over one half of the normal children. On the goal-detection tasks, although there were autism-specific impairments on both tasks, performance on the (more ambiguous) teasing trials more reliably dissociated the autism group from the controls than performance on the blocking tasks.

8.2.4 Imitation

The imitation tasks did not produce an autism-specific impairment in imitation. Children with autism produce *some* imitation, although few did so reliably, with only

2 of the 13 subjects with autism imitating the modelled action on three-quarters of completed trials. However, the performance of children with autism did not differ from that of the developmental delay controls. The significant covariate effect for NVMA showed that across all groups children with a higher NVMA produced more imitation, which may explain the more reliable performance of the normal controls, 15 out of 17 of whom were reliable imitators.

8.3 REVIEWING THE STATUS OF THE CANDIDATE PRECURSORS

In summary then, autism-specific impairments were found on measures of empathic responsivity, pretend play and joint attention, but not imitation or attachment. Other studies with older children with autism have also found intact basic-level imitation skills and attachment behaviours (see Charman and Baron-Cohen, 1994a; Capps et al., 1994; for reviews). Thus, the status of imitation and attachment as precursors to a theory of mind is considerably weakened (Meltzoff and Gopnik, 1993; Rogers and Pennington, 1991; Fonagy et al., 1991b). The developmental delay group were not impaired, relative to the normal controls, on any of the precursor measures when their developmental immaturity was taken into account. Therefore, the results provide some support for claims that each of the other candidate precursors are functional precursors to a theory of mind: empathic responsivity (Hobson, 1993a,b), pretend play (Leslie, 1987), and joint attention (Baron-Cohen, 1993, 1994; Mundy et al., 1993).

However, consideration of theories which describe how the candidate precursor abilities are developmentally related to each other will usefully inform further

discussion of the present findings. At times, the recent debates within developmental psychology regarding the development of a theory of mind, and its impairment in autism, have sometimes been crudely characterised as a competition between theories which advocate a primary affective deficit, and those which advocate a primary cognitive deficit (see Baron-Cohen, 1988; Hobson, 1989a; Leslie and Frith, 1989). However, more recently several important theoretical and empirical papers have embraced the *interdependence* of cognitive and affective development, and the present discussion will assume this context (Dunn, 1994; Harris, 1994a; Hobson, 1993b; Mundy et al., 1993; Tomasello et al., 1993).

8.3.1 Relationships between the precursors and theory of mind

Several theories of the relationships between the candidate precursors have been put forward. Some models favour *linear* relationships between the abilities:

- * Hobson (1993a,b) proposes that the fundamental underlying lack of affective responsivity operating from birth would lead to the deficits in pretend play and joint attention found in both older children with autism, and in the infants with autism studied here
- * Klin, Volkmar and Sparrow (1992) cite the existence of autistic deficits in "pre-mentalizing" social and affective abilities as evidence for the primacy of social deficits which affect later mentalising abilities

- * Baron-Cohen (1994) proposes that joint attention, in the form of his Shared Attention Mechanism (SAM) is a critical precursor of the ability to form the triadic relational terms necessary to develop a theory of mind (ToMM), whose earliest manifestation is pretend play.

In contrast, the model put forward by Mundy et al. (1993) argues that a *combination* of affective and cognitive impairments co-exists to produce autism. Whilst the present cross-sectional study cannot provide clear support for or against these competing theories, several suggestive findings emerge. First, *both* affective and cognitive impairments were found in 20-month-olds with autism, the youngest sample studied to date. Certainly, whatever deficit underlies autism, it has affected both cognitive and affective development in autism by the end of infancy. However, this does not discriminate between the competing theories, as all would predict affective and cognitive impairments by late infancy. However, some support is provided for Baron-Cohen's (1994) model, that the SAM is in place before ToMM, by the finding that in all but one child with autism, pretend play (assumed to rely on ToMM) was only found in children who showed joint attention behaviour (assumed to rely on SAM).

Another difficulty with interpreting the present results as supporting one or other of these competing hypotheses regarding the relationships between the precursor abilities is that although autism-specific impairments were found on measures of affective responsivity, pretend play and joint attention, the performance of the autism group was not at floor, nor that of the controls at ceiling on most measures. This is also true of the performance of samples of children with autism on theory of mind tasks (Baron-

Cohen, 1993; Happe, 1994a). Comparisons made between the children with autism and the controls are not all-or-none. Two considerations must therefore be made. First, the population with autism is not homogenous in either its theory of mind ability (Happe, 1994b), nor it follows by extension, in its precursor abilities. Second, there is growing acceptance that autistic disabilities occur along a spectrum, or continuum, of abilities (Wing, 1988). Thus, some children with autism may develop some intact precursor abilities, albeit delayed, and go on to show some intact theory of mind competence, although as Happe (1994b) has shown they may still show the characteristic pattern of social impairment. Therefore, any conclusions reached from such experimental research with such a small group of subjects with autism should be interpreted with caution.

In the only previous experimental work to directly address this issue, Sigman and Mundy (1993) compare the possible precursor relationships in the development of children with Down's syndrome and children with autism. They conclude that different variables may be important precursors of development in different populations of children. The example they provide of such a dissociation is that in children with Down's syndrome nonverbal requesting but not joint attention skill is an important correlate of language development, while the converse is true for children with autism (Kasari et al., 1990; Mundy et al., 1990). Thus, the causal developmental relationships which emerge from such research indicates not only that different mechanisms operate at different points in development, but also that different mechanisms may operate in normal and abnormal populations, or in different abnormal populations.

However, important questions about the specificity of the status of the precursors, the relationships between the precursors themselves, and their mode of operation (see Gomez et al., 1993; Hay and Angold, 1993) cannot be answered by the present cross-sectional research design. Bradley and Bryant (1983) and Happe (1994a) warn us that whilst cross-sectional research designs may tell us about relationships between precursors *online*, they cannot tell us about the *developmental* causal relationship. Clarification will await the outcome of longitudinal research and training studies, such as those by Sigman and Mundy (1993) and Gopnik et al. (1994). The present sample will be followed-up when aged 42 months and clearer evidence for the status of the candidate precursors to a theory of mind may emerge from this longitudinal perspective.

Another important cautionary note, is that whilst adoption of research strategies that follow from the theory of mind deficit account of autism may prove productive, they are not the only avenues that should be pursued. Alternative accounts which propose deficits which may be primary, or parallel, to their problems in mentalizing, such as the executive dysfunction account (Bishop, 1993) or other alternatives such as that proposed by Harris (1994b), should also be considered in the design and interpretation of future research. Nevertheless, one important consequence of the present study should be that research into the fundamental deficit in autism should take account of both cognitive and affective abilities, in order to avoid excluding important information about the role of both in the developmental history of autism (Charman, 1994b; Mundy et al., 1993).

8.2 CLINICAL IMPLICATIONS OF THE PRESENT RESEARCH

One clinical question of importance is the potential for tests of precursor of a theory of mind competencies to aid in screening for autism in high-risk populations, or to be routinely employed in the diagnostic process in the clinic. Certainly, the use of the CHAT has already demonstrated a role for joint attention and pretend play in the screening of populations in order to identify children at risk of developing autism (Baron-Cohen et al., 1992, 1994). Whether such a screening tool could be aided by the introduction of questions regarding affective, as well as the cognitive, development will require further research. Retrospective parental accounts, as well as videotapes taken in infancy, suggest that the picture of autism in infancy does include both affective and cognitive deficits, and this view is further supported by the present findings (Adrien et al., 1991a,b; 1992; Dahlgren and Gillberg, 1989; Ohta, et al., 1987; Osterling and Dawson, 1994). Further, the high specificity and sensitivity of the tasks in identifying children with autism from the controls in the present sample raises the possibility that tests measuring precursor abilities could contribute to the differential diagnosis of autism, alongside rating scales and interview schedules (Baron-Cohen and Howlin, 1993). However, it is not suggested that the present tasks in their current form could be used clinically. Further work would have to be undertaken with both normal and clinical populations before the present tasks could be adapted for used in the clinic.

8.3 LIMITATIONS OF THE PRESENT RESEARCH

There are several limitations to the present study, which should sound a note of caution for both the theoretical and the clinical suggestions made above. The major limitation is that the sample of children with autism studied may not be representative of the autistic population as a whole. First, whilst the CHAT was successfully able to identify children with autism from the general population at 18 months, data on the numbers of children in the population who go on to develop autism but who were not identified by the CHAT will not be available until the whole-population sample is followed-up at age 42 months (Baron-Cohen et al., 1994). In addition, since 2 of the children with autism studied were identified not in the autism risk group, but the joint attention/language delay group, of whom only a subsample were followed up in the clinic and included in the present study, not all of the potentially identifiable children with autism from the know population were seen (Baron-Cohen et al., 1994). In addition, subgroups of children with autism may exist whose pattern of development differs considerably in infancy and afterwards. Indeed, for some children development may proceed normally for the first two years before a pattern of (late onset) autistic development emerges (Volkmar and Cohen, 1989). Whether or not the same mechanisms underlie these periods of intact and impaired social development is a question for future research.

Another limitation in the representativeness of the present autistic sample is that whilst most autistic children show impairments in their development of a theory of mind, a significant subgroup of children with autism go on to develop at least a rudimentary

theory of mind (Happe. 1994a), as well as competence in at least some of the precursor tasks (Baron-Cohen, 1993). Given that the autistic sample studied were identified via their performance on precursor to a theory of mind tasks, as assessed by the CHAT (Baron-Cohen et al., 1992, 1994), we would expect to have *selected out* those children with autism who may have more intact theory of mind (and precursor) competence, but who will still go on to show the characteristic autistic impairments in social behaviour (Happe, 1994b). If a representative sample of the total population with autism were included, the autism-specific impairments found in the precursor abilities might not hold up.

Another characteristic of the present sample of children with autism was their relatively mild level of developmental delay. Whilst they were matched with a NVMA and LA comparison group, their mean NVMA delay was just over 3 months, placing them in the lowest-functioning 16% of the population, and their mean LA z-score placed them in the lowest 5% of the population. Over three quarters of the autistic population have IQs in the mental handicap range (placing them in the lowest 2.5% of the population) (De Myer, 1976; Gillberg, 1990). Thus, the present sample constitute a relatively high-functioning sample of children with autism, whose performance may not be generalizable to the more disabled total autistic population (Charman, 1994a).

A further cautionary note should be made regarding the diagnosis of autism applied to the present sample. Whilst standardised diagnostic tools were rigorously applied, the diagnosis of autism at the young age of 20 months is unusual, and until the present

sample and other young samples (Lord et al., in press) are followed-up longitudinally the diagnoses applied should be considered presumptive, and will be confirmed at age 42 months when the sample will be seen again.

8.4 CONCLUSIONS AND SUMMARY

In summary, the present study provides some support for the status of empathic responsivity (Hobson, 1993a,b), pretend play (Leslie, 1987) and joint attention (Baron-Cohen, 1993, 1994; Mundy et al., 1993) as precursors of a theory of mind. Autism-specific impairments were found in each of these candidate precursor abilities in a sample of 20-month-olds with autism. The case for imitation and attachment as precursors (Fonagy et al., 1991b; Meltzoff and Gopnik, 1993; Rogers and Pennington, 1991) was significantly weakened by the lack of autism-specific impairments. However, the precise developmental relationships between the candidate precursors, and their relationship to the later development of a theory of mind, awaits further research. Whether the present findings are applicable to all children with autism will also await the study of other samples. An important finding, for the future of both theoretical and potential clinical developments of the theory of mind theory of autism, is that even in this very young sample of children with autism both *cognitive* and *affective* impairments were found, and future work should resist a focus on one aspect to the exclusion of the other, in order to help us unravel the normal development of a theory of mind, and its impairment in autism.

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